TWENTY-FOURTH ANNUAL REPORT

OF THE

SECRETARY

OF THE

STATE HORTICULTURAL SOCIETY

OF

MICHIGAN

1894

BY AUTHORITY

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1895

REPORT OF THE SECRETARY

OF THE

MICHIGAN STATE HORTICULTURAL SOCIETY.

ALLEGAN, MICHIGAN,
December 31, 1894.

TO HON. JOHN T. RICH, *Governor of the State of Michigan:*

I have the honor to submit herewith, in compliance with legal requirement, the accompanying report of 1894, with supplementary papers.

Respectfully yours,

EDWY C. REID,

Secretary of the Michigan State Horticultural Society.

OFFICERS

OF THE

STATE HORTICULTURAL SOCIETY FOR 1895.

PRESIDENT—ROLAND MORRILL, Benton Harbor.
VICE-PRESIDENT—C. J. MONROE, South Haven.
SECRETARY—EDWY C. REID, Allegan.
TREASURER—ASA W. SLAYTON, Grand Rapids.
LIBRARIAN—ROBERT L. HEWITT, Lansing.

EXECUTIVE BOARD.

L. D. WATKINS, Manchester, 1 year.
L. R. TAFT, Agricultural College, 1 year.
C. W. GARFIELD, Grand Rapids, 2 years.
F. J. RUSSELL, Hart, 2 years.
C. J. MONROE, South Haven, 3 years.
T. T. LYON, South Haven, 3 years.

STANDING COMMITTEES.

ON FRUIT CATALOGUE—L. R. TAFT, Agricultural College, Chairman; T. T. LYON, South Haven; A. A. CROZIER, Agricultural College; W. A. SMITH, Benton Harbor; C. A. SESSIONS, Grand Rapids.

ON NEW FRUITS—T. T. LYON, Chairman; C. A. SESSIONS, Grand Rapids; S. R. FULLER, Eaton Rapids; C. ENGEL, Paw Paw.

ON FINANCE—C. J. MONROE, L. D. WATKINS, C. W. GARFIELD.

ON ENTOMOLOGY—G. C. DAVIS, Chairman.

ON VEGETABLE PHYSIOLOGY—L. R. TAFT, Chairman.

ON LANDSCAPE GARDENING—E. FERRAND, Chairman.

ON VEGETABLE GARDEN—W. W. TRACY, Chairman.

ON FORESTRY—C. W. GARFIELD, Chairman, Grand Rapids; L. R. TAFT, Agricultural College; C. A. SESSIONS, Grand Rapids.

CONSTITUTION

OF THE

MICHIGAN STATE HORTICULTURAL SOCIETY.

ARTICLE I.—NAME, TERRITORY AND OBJECTS.

The name of the society shall be the Michigan State Horticultural society, and its territory shall be the state of Michigan. Its objects shall be the devolopment of an adequate appreciation of the peculiar adaptation of the soils and climate of the state to the pursuit of horticulture in all its branches; and the collection and dissemination of information bearing upon the theory and practice of the same, as well as upon the arts and sciences directly or indirectly associated therewith, or calculated to elevate or mprove the practice thereof.

ARTICLE II.—OFFICERS AND MODE OF ELECTION.

The officers of the society shall be a president, a secretary, and a treasurer, together with an executive board of six members, aside from the president, secretary, and treasurer, who shall be *ex officio* members of the said board.

Said board shall designate one of its members as vice-president. The officers shall be elected by ballot.

ARTICLE III.—A QUORUM.

Four members of the executive board shall constitute a quorum for the transaction of business at any meeting of said board: *Provided*, That each of the members thereof shall have been notified, in the usual manner, of the time, place, and object of such meeting.

ARTICLE IV.—ANNUAL MEETING AND ELECTION OF OFFICERS.

The annual meeting of the society, for the election of officers specified in Article II, shall occur during the time between December 25 and 31 of each year, according to call of president and secretary, and the election shall be held during the second session of such meeting.

ARTICLE V.—TERMS OF OFFICE.

The officers specified in Article II shall hold their offices until the thirty-first day of December of the year for which they were elected, and thereafter until their successors shall have been elected, and shall have signified to the secretary their acceptance: *Provided*, That the terms of office of the six members of the executive board shall be so arranged that but two regular vacancies shall occur in each year.

ARTICLE VI.—ANNUAL AND LIFE MEMBERS.

Any person may become a member of the society for one year by paying to the treasurer the sum of one dollar; and the yearly term of all annual memberships shall expire on the thirty-first day of December of the year for which they were taken, but be regarded as continuous, except as may be provided by the by-laws. Any person may become a life member by the payment at any one time of the sum of ten dollars into the treasury of the society.

ARTICLE VII.—AMOUNT OR LIMIT OF PROPERTY.

The society may hold real and personal estate to an amount not exceeding twenty thousand dollars.

ARTICLE VIII.—BY-LAWS.

By-laws for the government of the society shall be framed, and when needful, amended by the executive board; but changes thereof may be at any time proposed by the society in general meeting.

ARTICLE IX.—AMENDMENTS.

This constitution may be amended at any regular meeting of the society by a vote, by ballot, of two thirds of all the members present and voting: *Provided*, That notice of such proposed amendment, specifying its purport, shall have been given at the last previous regular meeting.

BY-LAWS OF THE MICHIGAN STATE HORTICULTURAL SOCIETY.

I.—THE PRESIDENT.

1st. The president shall be the executive officer of the society, and of the executive board; and it shall be his duty to see that the rules and regulations of the society, and of the executive board, are duly enforced and obeyed.

2d. He may, in his discretion, and in the lack of needful rules, during the recesses of the society and of the board, prescribe rules for the management of the interests or business of the society, such rules to continue in force till the next session of the executive board, and until, by its action, they shall have become no longer necessary.

3d. He shall act in conjunction with the secretary in the preparation of programmes or orders of business, for the sessions of the society; and in the devising of plans and processes for the maintenance of its interests.

4th. He shall have the best interests of the society at heart, and shall lead in forwarding any and all enterprises calculated to add to its permanency or to increase its usefulness, and establish it more firmly in the public confidence.

II.—VICE-PRESIDENT.

The vice-president shall perform the duties of the president in case of the absence or inability of that officer; and may be called upon by the president to assume the duties of the chair at any meeting of the society or executive board.

III.—THE SECRETARY.

1st. The secretary shall be the recording, corresponding, and accounting officer of the society, and he shall also be, jointly with the business committee, its financial and auditing officer.

2d. He shall incur no expenditure of a large or doubtful character except with the sanction of the executive board or of the business committee.

3d. He shall submit all bills or claims against the society to the business committee for approval, and indorsement to that effect, before drawing his order upon the treasurer for the payment of the same.

4th. He shall attend all meetings of the society, and of the executive board, and shall keep a faithful record of their proceedings.

5th. He shall sign all certificates of membership, and all diplomas and certificates of merit awarded by the society.

6th. He shall have charge of the society's books and papers, excepting only such as, by the advice or direction of the executive board, shall be placed in charge of the librarian, and he shall be responsible to the board for the safe keeping of the property placed in his charge.

7th. He shall be the custodian of the seal of the society, and shall have authority to affix the same to documents when needful.

8th. He shall seek by all suitable means to secure the fullest announcement of the meetings of the society in this state, as well as in adjacent states, when such shall be found desirable.

9th. He shall, so far as practicable, cause the transactions of the society, together with such valuable or interesting papers as shall be read at its sessions, to be properly published, and thus placed within reach of the state.

10th. It shall also be his duty, yearly, to prepare for publication the annual report of the society, together with such other matter as he shall deem proper—he being aided in the selection of such matter by an advisory committee of the executive board.

IV.—THE TREASURER.

1st. All the funds of the society shall be paid into the hands of the treasurer.

2d. He shall disburse the moneys of the society that shall come into his hands only upon the order of the secretary, countersigned by the president.

3d. He shall keep the moneys received by the society for life memberships as a distinct fund, and shall invest the same under the advice and direction of the executive board, applying only the interest accruing thereon to the purposes of the general fund.

4th. Immediately upon assuming his office, and before entering upon its duties, he shall execute to the society an official bond with sufficient sureties, conditioned for the safe keeping and disbursement of the moneys of the society, and for the proper discharge of the further duties of his office, in such sum as shall be specified by the executive board. Such bond shall receive the approval of the president and shall be deposited with the secretary.

5th. He shall, at the close of each year, report to the executive board the amount of money that shall have come into his hands during the year, the sources from which it has been derived, and the disposition made of the same.

V.—THE LIBRARIAN.

1st. The librarian shall have the custody of the library of the society. He shall be appointed by the executive board, and may be displaced at its pleasure.

2d. He shall act jointly with the secretary in the care and arrangement of the same, and in the reception, custody, and disposal of the volumes of the transactions annually supplied to the society by the state.

3d. He shall have the custody of the rooms assigned to the society at the state capitol, together with such books and other property as the society or the board shall direct to be deposited therein.

4th. He shall report annually, at the close of the year, to the executive board the amount and condition of the property in his hands.

VI.—THE EXECUTIVE BOARD.

1st. The executive board shall enact all rules and regulations for the management of the affairs of the society, determine the salaries of its officers, and assume the control and management of its exhibitions.

2d. It shall have power to displace any officer of the society for neglect of duty or abuse of position, and to fill all vacancies by appointment, to continue till the next annual election.

3d. The board shall hold four regular sessions during the year, to occur at the times and places for the regular meetings of the society.

4th. Other meetings may be called by the secretary under the advice or direction of the president, or of a majority of its members, at such times and places as may be deemed most convenient; but in all such cases each member must be notified of the time, place, and object of such meeting.

5th. It shall be the duty of the board to carefully guard the general interests of the society, to watch over its finances, and to provide for its necessities as they shall arise.

6th. All important measures shall be submitted to this board, but they may by the board be resubmitted to the society with recommendations.

7th. The board shall, at the annual meeting, submit through the secretary, in connection with the reports of officers, such further report upon the condition, interests, and prospects of the society as it shall judge necessary or expedient.

8th. Two members of the executive board are to be elected each year, to hold the office for three years, but if any such member shall absent himself from two or more consecutive meetings of the society and of the board, without reason satisfactory to the board, the said board may, in its discretion, consider the office vacant, and proceed to fill such vacancy by appointment, to continue to the next annual election.

VII.—THE BUSINESS COMMITTEE.

1st. It shall be the duty of the executive board, annually, upon entering upon the duties of the new year, to appoint from their own number three members who shall constitute a business committee for the year.

2d. All accounts or claims against the society, when presented to the secretary for payment, shall, before payment, receive the sanction and indorsement of the business committee.

3d. Such claims shall be submitted to this committee and approved in duplicate, one copy to remain with the secretary as his warrant for the payment of the same, and the other to be transmitted by him to the president, along with his order upon the treasurer, as his warrant for countersigning the same.

4th. It shall be the duty of the business committee, upon application of the secretary, during the recess of the executive board, to advise with him as to the expediency of making any contemplated but questionable expenditure for which occasion may arise during such recess.

VIII.—STANDING COMMITTEES.

1st. There shall be a standing committee on revision of the catalogue, to be composed of one member from each of the five districts into which

the state is, for this purpose, divided, with one member chosen from the state at large, who shall be the chairman of the committee.

2d. Each member of said committee (except the chairman) is empowered and expected to choose a sub-committee for his district, of which he shall be chairman.

3d. It shall be the duty of each sub-committee to collect and report, each year, to the general chairman, such facts respecting fruit culture in the district as shall promise to be of value in the revision of the catalogue.

4th. There shall be a standing committee on new fruits, to consist of a chairman, with as many associates as such chairman shall find it desirable to appoint.

5th. Such other standing committees may from time to time be appointed by the executive board as, in its discretion, it shall deem desirable or necessary.

6th. All standing committees are expected to report at the annual meeting in December, any information of value to the society or its members that may have come to their knowledge during the year, as well as any scientific theories, deductions, or facts that, in their opinion, may be useful in advancing the objects for which the society is laboring.

IX.—LIFE MEMBERSHIP FUND.

1st. All moneys coming into the treasury of the society in payment for life memberships shall constitute a perpetual fund, to be known as the life membership fund.

2d. The principal of this fund shall be invested by the treasurer under the advice and direction of the executive board.

3d. All interest accruing upon any portion of said fund shall constitute and become part of the fund of the society devoted to the payment of its ordinary expenses.

X.—MEETINGS OF THE SOCIETY.

1st. The society shall hold its first regular meeting for the year during the month of January or February for the inauguration of the officers chosen at the annual meeting held the previous December, as provided in article IV of the constitution, and also to arrange its plan of operations for the year.

2d. Its second regular meeting shall be held in the month of June at such date as shall best accomodate an exhibit of the early summer fruits.

3d. Its third regular meeting shall be at its annual exhibit of autumn and winter fruits, in the month of September or October.

4th. Its fourth regular meeting shall occur in connection with its annual election of officers, in December, as provided in article IV of the constitution.

5th. The times and places for the occurrence of these regular meetings (excepting only the *time* of the annual meeting), shall be determined by the executive board.

6th. Other meetings may be called by the secretary, under the advice or direction of the members of the executive board, at times and places by them deemed expedient.

7th. In case of the calling of a special meeting for the election of officers of the society, in consequence of any failure to elect at the annual meeting, as provided in section IV of the constitution, all persons entitled as members to vote at such annual meeting shall be considered as retaining such membership for such purpose until such election, and until such officers so elected shall have been inducted into office.

XI.—RULES FOR DISCUSSIONS, ETC.

1st. The deliberations and discussions of the society shall be conducted in accordance with ordinary parliamentary usages.

XII.—AUXILIARY SOCIETIES.

1st. The society shall, in all reasonable and proper ways, encourage the formation of local horticultural or pomological societies auxiliary to this society in all such counties or other municipalities of this state as shall afford a reasonable prospect that they will be able effectually to maintain the same.

2d. It shall be the policy of this society in supervising the organization of such local auxiliaries to secure an identity of constitutional provisions throughout, and in so doing to insure harmony among them; but at the same time it will not discourage the including by them of special or local objects in cases in which such shall be found desirable, so long as the introduction of the requisite provisions therefor into the constitution and by-laws of the auxiliary society shall not be deemed likely to interfere with the harmonious workings of the whole.

3d. Any person may become a full member of an auxiliary society, for one year, by paying into its treasury the sum of one dollar; and a compliance with the provisions of clause fifth of these by-laws shall constitute him also a member of this society for the same term.

4th. The wife, and the resident single or unmarried daughters, of any full member, may also become members of such auxiliary society upon the payment of fifty cents each: *Provided*, That in such case such entire family shall become entitled to a single copy, only, of the current volume of the transactions of this society.

5th. On receipt of the names of such members, with the required fees, the secretary shall immediately transmit their names and postoffice addresses, together with half the membership fee of each, to the secretary of this society, who shall record the same and pay the money into the treasury for the benefit of the general fund.

6th. It shall be the duty of the secretary, on receipt of such remittance, with list of members, to supply each auxiliary society with a certificate of membership in this society for one year, together with a copy of the current volume of transactions for each full member so remitted for.

7th. The proceedings of such auxiliary society shall, at the close of the year, be forwarded, in succinct form, to the secretary of this society, to be by him incorporated into the annual volume of transactions, accompanied by a list of its members for the year.

8th. The auxiliary societies shall, so far as practicable, be made the medium for the distribution of the annual volumes of the transactions of the society, the nuclei for its meetings, and the means of creating interest

therein, as well as the means of collecting such facts or other information or material as shall, from time to time, become needful or desirable in the conducting of its various operations.

XIII.—AMENDMENTS, ADDITIONS, SUSPENSIONS.

1st. Amendments or additions to these by-laws may be made by a majority vote of the executive board, at any meeting; but if objections shall be made the same shall "lie upon the table" till the next regular meeting of the board.

2d. These by-laws, or any one or more of them, may be suspended for the time, by order of a majority of all the members of the society present and voting.

3d. A proposition in the general meeting of the society for an amendment or addition to these by-laws shall be referred to the executive board for consideration and decision; but the society may submit therewith its advice or request.

4th. All amendments of the constitution and by-laws of auxiliary societies shall, before they shall take effect, be submitted to the executive board of this society, by whom their approval or rejection shall be considered upon the principle provided in section XII, clause 2, and the determination of said executive board shall be final and binding opon the auxiliary society.

PROCEEDINGS OF THE WINTER MEETING.

HELD AT CHARLOTTE, FEBRUARY 14-16, 1894.

WHILE at this meeting there was a number of excellent papers, the discussions were of a rather primary kind, being mainly instructions from the experienced horticulturists present to those who, in the vicinity of Charlotte, are about to embark in fruitgrowing in a commercial way, or who are owners of orchards once fruitful but now unproductive from neglect. For these reasons there will be but little of the latter feature of the transactions reported, because it would be a restatement of what appears in many places in these Reports.

The meeting was held in conjunction with the annual meeting of the Eaton County Agricultural Society, and the union proved to be greatly to the mutual advantage of the societies.

The Eaton county fair is in one respect an anomaly among fairs, in that it is managed, and with remarkable success, by two editors. In turn, these two editors were not long ago farmers, but whether they were successful or otherwise as agriculturists, they are decidedly so as journalists. It almost goes without saying that they make of the fair a complete success, showing the past year, when every other fair in the state lost money, a balance of nearly $500 in the treasury, with scarcely any demands upon it. These officials are Messrs. F. N. GREEN of the Olivet Optic and GEORGE A. PERRY of the Charlotte Tribune. They were, respectively, president and secretary of the fair.

The programme was a long one, covering in time from Wednesday evening to and including Friday evening—seven sessions. The papers furnished by the local society were many and in every case meritorious. Mayor FRANK MERRITT made an excellent address of welcome, to which Mr. GARFIELD responded. Mr. J. C. NICHOLS, a Charlotte attorney, treated the "Tramp evil," suggesting methods for its abatement. Hon. D. STRANGE of Oneida spoke of "The wife's share in the family purse," treat-

ing the rather delicate subject in a sensible and pleasing way. A. F. CLAFLIN of Benton treated "Substitutes for clover, or how to save it," which brought out a valuable discussion upon the forage question. Mrs. LUCY BETTS of Chester had an interesting essay upon "Farmers' clubs, how made successful." One of the very best of the many good things was "Kitchen culture," by Mrs. MARIE SPRAGUE of Battle Creek, the ensuing discussion of houskeeping methods and participation in them by the men and boys being one of the most enjoyable half hours of the meeting. The whole closed with a lecture by Justice C. B. GRANT of the Michigan supreme court upon "The enforcement of law," in which the learned jurist clearly showed how and why it is the duty of officers, and not alone of the private citizen, to see that crime is repressed and criminals hunted down and justice meted to them.

At many times through the programme the very best of music was supplied. This was also greatly varied. There were vocal solos, quartets, and choruses, some of these being furnished by the Congregational choir of Vermontville, and in part by Charlotte people. Besides, there was, the first evening, an excellent orchestra, and at other times various instrumental pieces. Not content with this treat, recitations in wide variety were provided, both by ladies and by two lads, one of these of such tender years or diminutive size as to need mounting on a table to get him within sight of his auditors. But each selection was admirably rendered—in strong contrast to the usual run of such things.

Friday afternoon, under the lead of Mayor MERRITT and Mr. PERRY, with assistance from President MORRILL, a local horticultural society was formed, to become auxiliary to the state society. In rapid succession sixty-five members were enrolled. A temporary organization was effected with Mr. MERRITT for president, Mr. L. W. WILTON secretary, and Mr. O. E. PACKARD treasurer.

There was a most remarkable attendance. At no time was there a vacant seat in the large circuit-court room, while in most of the sessions extra benches and chairs had to be brought in, and even then people sometimes had to go away unable to so much as get into the room.

The Thursday evening session was mainly occupied by two papers, the one by Prof. L. R. TAFT, upon "Plant Diseases," the other by Prof. GLADDEN, also of the Agricultural College, upon "Potatoes." It is deemed unnecessary to reproduce either of them here, the one being covered frequently in the Annual Reports of the State Society, and intended for primary instruction for the beginners at Charlotte; and the other concerned field culture of the potato rather than growing potatoes in gardens, and therefore is more germane to agriculture.

The session of Friday morning began by the appointment of committees as follows:

Resolutions.—Messrs. L. D. WATKINS of Manchester, R. M. KELLOGG of Ionia, C. P. CHIDESTER of Battle Creek.

Exhibits.—Messrs. L. R. TAFT of Agricultural College, W. W. TRACY of Detroit, CHAS. SHRIVER of Benton Harbor.

The session of Friday afternoon, February 16, of the winter meeting of the State Horticultural Society, was opened by a paper on "Insects and Insecticides," by Prof. G. C. DAVIS of the Agricultural College. It was a general resume of this topic, stating in comprehensible form the current knowlege upon this subject so far as relates to horticulture. Its publication is omitted for the same reason as given in case of the paper by Prof. TAFT.

The most enjoyable part of the whole, perhaps, to the many who attended from about the state, was the charming hospitality of the people of Charlotte, who opened to them their homes in cheeriest hospitality. So cordial was the welcome, so abundant was the provision for the guests' comfort, that one allotment of visitors vied with another in praise of their entertainers; and long will they remember the cordiality and comfort of their visit to Eaton's handsome county seat.

PAPERS AND DISCUSSIONS.

THE NEW PRESIDENT'S INAUGURAL ADDRESS.

BY MR. ROLAND MORRILL OF BENTON HARBOR.

The Michigan State Horticultural society is now entering upon the twenty-fourth year of its existence. That its life has been one of usefulness can not be denied. One has only to look at its annual bound Reports, and know how well they have been received by the horticulturists of America, to realize that ours has been a successful career. Permit me to read right here article 1 of our constitution.

ART. 1. The name of this society shall be the Michigan State Horticultural society, and its territory shall be Michigan. Its objects shall be the development of an adequate appreciation of the peculiar adaptation of the soils and climate of the state to the pursuit of horticulture, in all its branches, and dissemination of information bearing upon the theory and practice of the same, as well as upon the arts and sciences directly or indirectly associated therewith or calculated to elevate or improve the practice thereof.

This explains the whole intention and desire of the society in a nutshell. The extent to which they have carried out their original intention has only been limited by the men and means at their command. In these respects no state has done better. Still, much more might be done by the society if allowed the facilities and encouragement they are entitled to. There is no method by which the material wealth of our state can be so rapidly increased as by the proper development of her horticultural resources, and the state society must always be looked to as the medium through which correct information regarding the ways and means of such development can be secured.

Never in the history of our state has there been greater interest manifested in horticulture than now. In such times many people are likely to make mistakes from lack of correct information. To prevent this, so far as possible, must be the duty of the state society. This can be accomplished by the dissemination of correct information regarding varieties of fruit, methods of culture, insecticides, fungicides, and markets. The amount of such information that can be collected and distributed by the state society is only limited by the desire of the people and their willingness to join with us in this work. The conditions today aré such that no man can keep up with the horticultural procession unless he attaches himself to some such organization. There is so much to contend with and so much information needed, even in advance of publication, that, I repeat, it is impossible to keep up without the advantage of such association.

Probably no state in the union is better located for commercial horticulture than Michigan, a very large proportion of her soil being remarkably well adapted to the production of choice fruit and vegetables; the best city market in America right at our door; the great northwest nearer to us than to any other fruit region; the immense lumber and mining markets on our north; plenty of good railways; cheap water transportation on all sides, all combined give us the best advantages of any state, and it is no wonder that we have attained the high position we now hold. Still, what we now have is only a beginning toward what we shall have twenty years later.

The fact that we have cheap transportation and excellent markets near by has been the means of giving Michigan in some respects a lower reputation than she deserves. Many growers send their low-grade fruit just the same as the best. If Michigan was compelled to ship her fruit as far as California, to reach a market, her reputation would be of the highest, as she would then utilize her low-grade fruit at home and her reputation would be world-wide. "California can not ship her low-grade fruit to market, as it would not pay the freight."

If a reform is ever made in this particular it must come from a better education, by popular sentiment, or by that harshest of all remedies, ejection from our markets by smarter men. This can never be done if we combine for mutual benefit and heed the plain dictates of common-sense.

It is a fact that there is not sufficient organization in our line in this state to control or even reach the majority with information or even suggestions for their own benefit. That this is the case is not the fault of the leading men of the state. It is that of the commercial growers. The loss is also theirs, and the remedy rests entirely with them. The state society, as well as the various local societies, gladly welcome them as members and through them all information is disseminated.

The state society should, by virtue of its charter, larger membership, and position, be the recognized head of the horticulture of the state. The various local and auxiliary societies, by working in harmony with the state society, can always be most useful, all working together for common good.

With this idea in view, none but men with broad ideas, unselfish spirit, and a willingness to work for common good should be elected to office in this or any other society. A better education than generally exists seems necessary to make successful horticulturists. It is apparent to any thinking man that, in the near future, to make a success we must have a fair understanding of botany, chemistry, mycology, entomology, and a good practical understanding of nature's laws in general. This can hardly be attained by many of us who are well along in years; but we have trained men working in these lines in our experimental stations, and we get the results of their labors for the asking. Our general government has established these stations for the purpose of saving us time and money, giving us full and practical information on topics which interest us, and we can get in no other way without great expense.

In connection with this, allow me to speak of a sentiment which prevails among a certain class of farmers, that our scientific men are not practical. Nothing could be further from the truth. Science is the very essence of practice, and no man can be a successful instructor who is not intensely practical.

It is only a few years ago that Prof. Cook and a few other scientific men were telling us that we could fight the codlin moth and canker worm by spraying with arsenites. His statements were considered ridiculous by many, and it took several years to get spraying into general practice. Our shrewdest men adopted it early, and to them science has revealed wonders.

Our professors have sent one remedy after another among us, until the insects, rots, mildews, and nearly all fungi are at our mercy by the use of the little $10 or $15 spraying outfit, which now all acknowledge must soon be as necessary a part of the farmer's tool outfit as his plow and harrow. Don't say that these men are not practical. Would that we were half as practical!

The value of our experiment stations can not be estimated, as their work is of such character that it saves us the loss of much valuable time as well as dollars. I feel that it is a safe statement that the knowledge gained by Michigan farmers, from our own and other experimental stations, and turned into good dollars, will run into the millions, and is rapidly increasing. Still, there was a move in congress this winter to repeal the Hatch bill under which these stations exist; but, fortunately, the farmers had a few friends left in congress and the movement was killed.

The busy season will soon be upon us, and there is every indication of an excellent fruit crop, especially of apples, and it behooves us to be ready to care for it. We should not wait for a thing until we need it, before securing it. We know that we can control the codlin moth and canker worm with Paris green, and the apple scab with Bordeaux mixture, and to apply either we must have a spraying pump. Be prepared and attend to these things on time, and we will probably be satisfied with the crop. Neglect them and we will be sorry for it.

When you secure a crop, pay a little attention to markets. It is just as essential to be a good salesman as it is to be a skillful producer. We can never sell a poor grade of fruit at top prices. Therefore, strive to produce the best. If you succeed in this, the fruit is more than half sold.

Do not think for a moment that you can always get the best price in the largest cities, unless you have established a reputation there. Look around you and see if you can not do better nearer home. We must learn that, while only the best fruit gets the top prices, there is plenty of demand for ordinary fruit at fair prices if it is only as good as it appears to be; but no profit can possibly come from deception. It is best that we experiment with new varieties in a moderate way. I do not mean by this the unheard of and impossible things so freely offered by the fruit tree sharper, whose song is now heard in the land from morn until eve. He is not out for his health, he sings for shekels, and gets them.

All fruitgrowers should be on the right side for good roads. None need them more than they and none can enjoy them more.

In conclusion permit me to speak of a matter which to me contains much to regret. I refer to the retirement of that grand old man who for seventeen years has presided over our meetings and has been the guardian of our society. To him is mainly due the prosperity and popularity of this society. His steady hand and clear head have guided us free of the many horticultural reefs which have wrecked so many promising organizations during those years. His courage and honorable convictions are known to all, and have been a pillar of strength to us. As a pomologist he stands today without an equal, and must be considered one of the great group with Downing, Wilder, and Barry. These names will pass down to posterity as the shining lights of American pomology. His private life has been spotless, and never has he been an idler. His time has been spent in doing good to his fellow men and for his adopted state. A man of fine education and refined taste, his voice has always been heard denouncing inferior and worthless varieties; careful with his statements regarding new ones, but never withholding a full measure of praise when merit was established; ever ready with a word of caution for the new beginner, we have come to believe him incapable of making mistakes or assuming false positions. We are pleased to say that his health is good, considering his age, and he is pushing his work along with all the vigor of a younger man; but his increasing infirmity of deafness has for years made it very difficult for him to preside at our meetings, and it has seemed absolutely necessary that some one should relieve him of that duty. He is still with us, and we hope to have the benefit of his counsel and the pleasure of his company for many years; and I know that every true-hearted horticulturist in this state will join me in a hearty "God bless you, President Lyon, for what you have done."

ADULTERATION OF FRUIT PRESERVES AND OTHER FOODS.

BY PROF. R. C. KEDZIE, MICHIGAN AGRICULTURAL COLLEGE.

If a man sells you anything as good as what you ask for, but yet entirely different, are you cheated? asked Mr KEDZIE. Some contend not. Mr. HAVEMEYER said to GEORGE GEDDES, in reference to refined sugar, that he could put in such an amount of glucose that no one could tell the difference, and net a profit of $1,500 per day. So, too, a man may say his butterine is as pure and wholesome as genuine butter, and therefore why not sell it as butter? With the man who will ask such questions there is no use for argument. He will sell it if he can.

In Chicago, twenty carloads of corn per day are turned into starch and glucose. The latter is now so refined as to be available for adulteration, whereas it was not so originally. As well might it be argued that peas may be sold for coffee and that there is no harm in so doing. One brand of coffee, with a prize in each package, was analyzed and found to contain but twelve per cent. of coffee. The correct principle is, that every article should be sold under its proper name. Let glucose be sold, but as glucose; let butterine be sold to those who wish to eat it, but as butterine, not as butter. In five pounds of glucose there is the sweetness of only three pounds of sugar. Let anyone have it who wants it, but he should not be deceived as to what it is.

As to vinegar, the manufacturers of it claim that their article is of great purity because it has so much acetic acid and so little foreign substance. Fruit vinegar does have acetic acid, but it has other constituents which give it flavor. Acetic acid is white, and these manufacturers add burned sugar and other things to give it color and flavor. Cider vinegar contains certain products of fermentation, including acetic ether, which give its peculiar flavor and odor. The Alden company's vinegar contains 2½ per cent of acetic acid, and they say that if they put in the legal amount it would be so strong that no one could use it. This is an excuse. Such vinegar is made for three cents per gallon and sells for twenty cents. Unless this fraud is checked, no one will be able to make cider vinegar at a profit.

Turning to the subject of jellies, Prof. KEDZIE showed samples of apple, raspberry, blackberry, and currant jelly, the latter colored with analine. But, said he, all are from the same kettle; only the flavors are different. He passed around the currant jelly for inspection. It was said to be from Pasadena, California. A pail of it, twenty-five pounds, may be bought for seventy-five cents. It could not be sent from California for that amount, even if made and packed for nothing. How can this be done, when a man using fruit and counting its cost as nothing, can not compete? Because in these jellies there is not a particle of fruit. The acid in them is sulphuric; a few of them may contain some other acid, but all have sulphuric acid in their composition. The jellies are made from starch—they come from the cornfield, not from the orchard.

Mr. KEDZIE made tests of these jellies for sulphuric acid and starch. There is no starch in the apple, yet the so-called apple jelly, when to it was

added a little iodine, to test it as to starch, turned a muddy black, as would be the case with any union of starch and iodine.

One bushel of cornmeal will make forty-five pounds of such jelly. Besides starch, there is used in making these jellies, glucose, detrine, and sulphuric acid. The glucose is boiled with a little sulphuric acid, and the process stopped a little short of the complete change, producing the gummy material for these jellies. Efforts are made to remove the sulphuric acid with lime, with the result that sulphate of lime is left and not all the acid removed.

A sample of apple jelly, bought in Charlotte, was tested, showing the same result as the others. It was sold for five cents per pound, and was made by FRANKLIN MCVEAGH & CO. of Chicago.

Is it injurious? asked Mr. KEDZIE. Well, if you wish to hang on to your teeth you must not eat sulphuric acid. On the other hand, if you are going to live on jellies, you will need no teeth!

Unless you fruitgrowers come to the front and put down these frauds and compel the sale of them by their correct names, your making of cider vinegar must go the wall. If jellies are to be so made and sold as fruit jellies, your fruit crops must suffer and your orchards must decrease in value.

Mr. WILCOX: If there is no law to reach these men, they must be a favored class. If I should put one-dollar potatoes into the center of fifty-cent apples, I would be arrested for fraud and convicted.

Mr. KEDZIE: You ought to be!

Mr. MORRILL exhorted the people to arouse public sentiment upon these questions, and, as a means to that end, the support of the State Horticultural society which labors to advance in every way the interests of fruit-growers. He knew of an institution in Chicago into which go three cars of corn per day, and a stream of syrup comes out.

Inquiry was made as to the manufacture of syrups from corn. Dr. KEDZIE said that this sort of fraud was shown up long ago, and for a time the sale of such syrups nearly ceased. If these things drop out when we drop upon them, we would better drop! Saccharine is made from coal tar, and has four hundred times the sweetening power of sugar, and this is used to tone up these syrups, which have little or no sweetness of their own.

The next day, Mayor MERRITT resumed the experiments with apple jelly, to reveal adulterations. After reperforming the experiments of Dr. KEDZIE, he produced some jelly, home-made from pure apple juice, and the mixture of iodine into it gave none of the dark color so quickly shown by the adulterated samples. Tests were also made with pulp of an apple, with the same result, while pulp of potato turned dark at once, because of the starch it contained, as in case of the Chicago "pure" jellies.

DAYS WITH EASTERN POMOLOGISTS.

BY CHAS. W. GARFIELD OF GRAND RAPIDS.

A few things noted on a recent visit among the horticulturists of the east may be of interest to the meeting. Everywhere, as at home, the markets are filled with oranges and bananas. This fact is depressing to our northern fruitgrowers, for although some of us try to get a grain of comfort in the belief that the tropical fruits eaten only whet the appetite for our northern products, we know that this is not true.

Fresh fruits from the south take the place of canned fruits and fresh fruits of our own growing. We must settle down to the fact that we will have to compete with this imported fruit by putting on the market only that which is the very best and most attractive. There is no doubt in my own mind, that for a large majority of people a fine Jonathan, Hubbardston, Oakland, Shiawassee, or Wagener apple is intrinsically of greater merit than the finest oranges, as dessert fruit. But apples of the quality of these are not common on our fruit stands, and when shown they are not carefully handled nor attractively exhibited, as are the imported fruits. It made my loyal blood boil when I stepped from the train for a few moments at Philadelphia, and was met by a boy crying "Florida oranges, Jamaica bananas, Malaga grapes and California Bartletts!" If our horticulturists were up to their opportunities, there would have been native grapes of the highest quality and of exquisite beauty; and Jersey pears finer than California Bartletts, with which to attract customers, in place of the beautiful but less toothsome importations.

I took a meal in a dining-car, and after getting pretty well satisfied asked for fruit. I was given a plate containing a large banana, a beautiful Navel orange, and a poor, scabby Rawle's Janet apple—with a worm in it. There was no excuse for this, because New Jersey had a fair crop of apples last season, and, by the basket, they were selling in Trenton at very reasonable prices.

The trouble is, we do not appreciate our own fruits, and the care and attention required to place them on the market at their best.

At the meeting of the New Jersey board of agriculture, which I attended, the horticulturists several times attempted to get before the meeting a resolution urging the legislature to enact some laws with regard to the destruction of noxious insects. I confess to having been somewhat in sympathy with the men who prevented the passage of a resolution of this character, for I have little sympathy with men who expect to find a remedy for all ills in "Be it enacted." The money and energy expended in securing the enactment of many laws of the character sought here, and the enforcement of them, if put into the dissemination of information, enlightening the people in regard to what they would better do in self-protection, would be far more wisely spent.

I visited the home of President WILLIAMS, of the New Jersey Horticultural Society, at Montclair. Mr. WILLIAMS is the most practical writer upon growing and handling grapes that I know, and I was interested to

see his vineyard. It consists of the better market sorts, and he manages each vine as if it were a pet. He knows its individuality and the best method to pursue that it may give the largest measure of profit. His pruning is very close, and he calculates just how many clusters of fruit each vine will perfect. He lives in his vineyard during the growing season, and I can well imagine that, before he takes his breakfast, a round in the vineyard is made, to see that his pets are all right. He bags his fruit, so that there are no chances taken on mildew and rot. He is not satisfied to sell his grapes by the ton, at lowest wholesale rates, but puts upon the market a fancy product that brings a fancy price.

I found a great many interesting things on Mr. WILLIAMS' place, among them an English walnut which bears regular crops, and a fine native chestnut grove.

Mr. WILLIAMS kindly drove me to many places of interest. The garden of Mr. CHAS. L. JONES, treasurer of the State Horticultural Society, who lives in Newark, was a revelation to me. Here, upon an area of 100 by 94 feet, including walks, is grown about everything that heart can wish, in the way of fruit, flowers, and vegetables. Among the fruits I noted an Early Richmond and a Black Tartarian cherry; ten pears in variety, which supply the family and many baskets to dispose of otherwise; two peach trees, Early York and Stump; two quince trees which some years, besides the family supply, bring in an income of over $20; seventy-three varieties of grape, very closely and neatly pruned, which must yield a large supply. I noted the area given to vegetables, and was told that the asparagus bed was eighteen feet square. A similar area was devoted to beets and onions. Tomatoes are grown upon a trellis. Early potatoes are grown upon ground subsequently in the season given up to a bed of strawberries, which in turn furnishes one crop the next season, and a crop of late sweet corn follows the strawberries. Lima beans, peas, cucumbers, pie-plant, and egg-plant are grown in abundance, and black and red raspberries, with a row of currant bushes, complete the list of fruits. Mr. JONES prefers Fay currants and Souhegan and Gregg black-caps, supplemented by Cuthbert, Montclair, and Golden Queen. I was told that Mr. JONES' roses, carnations, bulbs, and annuals were a great embellishment to the grounds, and the pride of the family.

This was a sample of intensive farming that gladdened my heart.

I visited the fruit farm of Mr. W. R. WARD of Newark, which furnished a goodly proportion of the fruit which graced the tables of the New Jersey world's fair exhibit, which, by the way, was a gem in the great horticultural building. I noted the acres of strawberries, mostly Downings, were well protected by a coating of rotten manure, and upon removing the cover I saw a wealth of plants for next season's crop. The pear orchards and currant plantations were exceptionally fine, but the matter of greatest interest to me was his cold storage house for pears. This was not the complicated affair I expected to find. It consisted of two cubical spaces, one above the other, well enclosed, and an ice house accompaniment. The lower space was beneath the ground and enclosed by a stone wall. Inside of the stone work was a wall of sawdust, with a good bed of sawdust upon the floor beneath. The upper space was enclosed by walls of sawdust on all sides, but the floor was of a thickness equal to the sawdust wall below plus the thickness of the stone wall. The floor of the upper space, which was the ceiling of the lower one, was open work with quite wide

spaces between the pieces. Fruit is stored in cubical boxes in the lower spaces, placed closely upon one another and covered over the top with loose pieces of board to protect from the direct falling of the drip from the melting ice, which is placed on the upper space in sufficient quantity to last two weeks at a time. There is no elaborate system of drainage and no method of absorption by use of chemicals to keep the fruit dry. The water from the melting ice is allowed to trickle freely through the packages of fruit, keeping the atmosphere of the storage space saturated constantly.

When Mr. WARD'S 1,000 bushels of Bartletts are ready to pick, he attends directly to the business of gathering the crop. He has no anxiety about the market, but first places his entire crop in the storage room. Then, while taking a rest after the arduous labor, he looks over the market reports and studies when and where to place his crop to best advantage. He feels safe about his fruit, and can take his time to market it; and when he places it upon the market he knows from experience that, because of the condition of moisture in which he has kept his fruit, it will stand up as if fresh picked from the trees.

We are just beginning to feel the importance of cold storage and appreciate its possibilities. Mr. WARD has certainly solved the problem for apples and pears. Other problems come in with soft fruits, not so easy of solution, and we have yet to learn the best method.

A novel arrangement I noted on a farm near Trumansburg, New York. A gentleman, whose name escapes me, has planted quite largely to peaches, pears, quinces, and apples. It will be some time before he will have fruit to sell, but cultivation and care of a high order must be given the growing orchards. That he may have an income during this interval, he raises early lambs for the great markets. He has erected a sheep barn with all conveniences, and in it is a silo. The roof of the barn is partly glass, and he is perfecting an arrangement for growing under this glass early vegetables and ornamental plants. When his fruit comes into bearing, his barn will be converted into a storage and packing house, and his silo into an ice-house and cold-storage room. All this with very little metamorphosis of the building. The plan seems logical and it is certainly unique. Its success, of course, will depend greatly upon the man.

The meeting of the Western New York Horticultural Society was a great treat to me. Rochester is a great center of a region teeming with progressive fruitgrowers. They were out in force at the meeting, and I have never attended a gathering of horticulturists more entertaining, unless it was the meeting of the American Pomological Society in Michigan some years ago.

Promptly at the hour of the meeting, the president Mr. W. C. BARRY, called to order, and his method of conducting the sessions reminded me strongly of his honored father, who was a prince among presiding officers. The management was somewhat autocratic, but no time nor opportunities were wasted. Everybody was alive, and there was no listlessness nor wrangling over non-essentials. Without a resolution, the president appointed committees, one of which arranged the order of business. The reports of these various committees were, when presented, adopted without a vote, upon the theory that, no objection being made, there must be general acquiescence. To my astonishment, the report of the committee to nominate officers was treated in the same way. The chair,

hearing no objection to the report, it was declared adopted, thus electing the officers for the ensuing year with no semblance of formality. This was delightful, for evidently the society has a good set of officials and there is no sense in wasting time in getting any other fellows in. The object of the meeting is to get out important information, not to log-roll for positions of honor.

Papers were uniformly short, and in discussing them, while a good deal of freedom was allowed, the society would not tolerate long a man who inaudibly mumbled his words, or another who had not learned the power of condensation.

It was expected that every man present would become a member, and invitations to join the society were frequent and urgent, but given with the utmost good nature and often with hilarity.

The president's address was replete with pleasant historical information and excellent suggestions connected with the trend of horticulture, and the opportunities that fruitgrowers must grasp or become side-tracked.

The papers presented to the meeting were usually short, meaty, and attractively put together. The discussions were always able and spicy. No time was wasted in rambling to no purpose, and the audience would not be patient when a man wandered from the subject or spoke unintelligibly. The conduct of the convention was a refutation of the slur often thrown out, that farmers are not business men.

I was especially delighted with Mr. GEO. W. CAMPBELL'S essay on "Grapes, new and old." He is a man greatly respected, and western New York makes no mistake in thus drawing upon Ohio for assistance.

J. H. HALE of Connecticut is always entertaining, and was especially so in his talk before this convention. He always mixes some good juice with his fruit talks that makes them exceedingly palatable.

Our own Michigan boy, Prof. L. H. BAILEY, finds in New York a delightful field for his ready suggestions and ability to work. The horticulturists there "swear by him," as if he were grown on their own soil. Michigan is honored by his success, and New York honored herself in recognizing his great ability as a horticulturist. He spoke upon the question, "Are novelties worth their cost?" and commanded the most perfect attention. He brought over with him from Cornell university fifty of his students, who were received with cheers by the convention and given every opportunity to absorb valuable hints from the proceedings. Cornell furnished several speakers, as did the State experiment station at Geneva.

One of the interesting features of the convention was a list of questions, over forty, upon practical horticulture, which had, previous to the meeting, been sent in for discussion. These were published in the programme and sandwiched into the proceedings in a very interesting way, giving brightness to the exercises and bringing out facts wanted by somebody.

The truth is, when a man prepares a paper he is at sea as to just what his audience wishes evolved; but, place him on the platform and allow an audience to fire questions at him, and if he is well equipped the people draw out the information they most desire.

The display of fruit was large, and so placed as to be of use to the meeting. An exhibit of forced vegetables from the state experiment station was very attractive and interesting.

The meeting was a model in many ways. In hospitality to outsiders; in recognition of facts, no matter how homely the garb in which they were presented; in the economy of time shown in the management of the society; in the utmost good nature which prevailed, and in the faith exhibited in the future of horticulture, I have rarely seen the equal and never the superior of this gathering of men.

ARE WE TO HAVE AN APPLE FAMINE?

BY W. F. BIRD OF ANN ARBOR.

As fond recollection presents to our view the scenes of our childhood, the orchard—ah! yes, the orchard—in summer its boughs bending beneath their loads of apples, and in winter the cellar filled with its luscious fruit of Spys, Rambos, Seeknofurthers, Baldwins, Newtown pippins, Talmans, Red Canadas, and dozens of other varieties. Contrast the present fruitless branches, the empty cellars, the cheerless hearth. We almost wish the past forgotten. The question above has come too late. We already have the famine; and, like the prodigal of old, having squandered our heritage, we are trying to fill our bellies with things that satisfy not—bananas, oranges, lemons, and the like. However cheap these may be, they can never take the place of apples.

We may not be wholly to blame for the famine, but, having come, it is ours to enquire the reason why.

It is the almost universal custom to tax the orchard land with other crops, the same as though there were no orchard there, and with no extra fertilizing. If trees have feeling, as some wise ones seem to think, they must rebel against such an odious tax. But, feeling or no feeling, the food supply once exhausted there is nothing to do but stand still and die a lingering death.

In this case it would seem to be plain that a little less cropping, a little more food, and better cultivation would be of great benefit. For want of these we are certainly to blame.

Another practice for which we are to blame, and which results in failure, is planting too closely together. And what is worse, in some sections where peaches are grown, apples and peaches are planted together alternately only a rod apart each way. An orchard of this kind stands in view from where I write. It is perhaps twenty-five years old. The land was strong and good and the peach trees bore abundantly; but they have long since passed away, and the apple trees are locked together like trees in the forest. Two rows on one side of the orchard were planted to pears instead of peaches. These have shot up into the sky to get light, but bear no fruit worth mention. The apple trees have borne one fair crop, and that is probably all they will do until some thinning, manuring, and cultivating is done.

During the past season my attention was called to a tree in the corner of an orchard which is worthy of note. On one side of the tree is a cultivated field, well manured; on another side was the hen-yard. Thus the tree had plenty of room and sunlight, and manure on two sides at least. As we might expect, it was loaded with bushels of fine fruit, while the rest of the orchard bore very little and inferior fruit.

Another cause of the famine for which we are to blame is neglecting to plant a new orchard every twenty years. We expect too much of the old orchard. It has paid for itself many times over, and we wonder why it does not keep on doing so forever. As well expect a good day's work from the old man who goes tottering on his cane.

For the insect enemies and fungous diseases we think we are not to blame. But even this is questionable. Nothing would help to multiply these enemies faster than simple neglect. We now have, I believe, remedies or preventives for every known enemy to the apple. Neglect of our orchards under these circumstances would seem about as reasonable as neglect of our children when they have scarlet fever or small-pox, or if starving to death.

Still, the question that confronts us on every hand is, will it pay to grow apples? It would be more sensible to ask, will it pay to grow fifty-cent wheat? We seldom hear such a foolish question asked, yet the business of wheat-growing goes right on as though it were paying the mortgage and putting money into the bank.

The question of apple-growing should meet with a decided answer in the affirmative. The day for profitable apple-growing is not yet past by a long way. The production of apples seems to be diminishing, while the demand is steadily increasing. Even apple scabs and worm-holes have found a ready sale of late years, while first-class apples bring almost any price named.

Science also comes to our aid to increase the demand for apples. It finds the apple composed of albumen, sugar, chlorophyl, malic acid, gallic acid, lime, and a larger per cent. of phosphorus than any other fruit or vegetable. This phosphorus is of immense value in toning up the nervous system. It was doubtless this property that gave the ancient Scandinavians the idea that the apple was the fruit of the gods, who, when they felt themselves to be growing feeble or infirm, resorted to this fruit for renewing their powers of mind and body.

The patent-medicine man has caught this idea, and is furnishing the phosphoric water of life in the bottle at great expense to us. Likewise the dentists all over the land are growing rich because we do not eat more apples. In the meantime we groan with toothache. And, strange to say, the acids of the apple correct, rather than provoke, acidity of the stomach. These acids are of immense value to people of sedentary habits, in eliminating from their disordered livers those noxious matters which, if retained, make the brain heavy and dull, inducing dyspepsia, jaundice, and skin diseases.

A knowledge of this fact, perhaps, led to the use of apple sauce with pork roast, rich goose, etc., the malic acid of the apple neutralizing the excess of chalk and fatty matter in the meat—a sort of a reciprocity treaty, as it were, between the fat goose and the rosy apple.

Though the question of the growing demand for apples is conceded, we are yet told that we can no longer grow them.

It is true that the failures of the past few years have been many and discouraging, and some of them beyond our control. But these may not occur again in a quarter of a century.

It is also true that we do not now see, nor can we hope for, the immense crops that the early settlers had almost for the asking.

The Lord was good to them, for they needed help. But he never designed that the earth should bring forth spontaneously forever.

It is not the design of this paper to go into detail as to the best method of growing apples, but to stimulate our zeal and brighten our hopes for the future. We already know much better than we do. Still, we need "line upon line," and I may here emphasize a few of the more important points connected with successful apple-growing.

The first is the stock to plant, and this may include the matter of varieties. One of the most common causes of failure is bad stock—stock propagated from old, worn-out, or diseased trees, black-hearted or nearly lifeless from careless handling, and, worst of all, not true to name.

Here allow me to digress long enough to say that this latter is a crime, and as fruitgrowers we ought not to rest until a law is passed to prosecute such criminality. We may now, in some cases, get the stock replaced; but even when this is possible, what satisfaction is it compared with the blasted hopes? A neighbor some years ago bought 1,800 peach trees. Not five per cent. of them were true to name, and the most of them worthless, so that he dug up the whole orchard. He did not even get the trees replaced.

Some years ago I bought a lot of grape vines for Worden. They turned out Concord. The former have been selling in our market at four to six cents, the latter at two to three cents per pound, a difference of $2\frac{1}{2}$ cents per pound, or fifty dollars per ton. So far this is all the satisfaction I have had. I might add many more such cases, many of which are the result of rascality, pure and simple.

At present our only partial remedy is to deal only with the most reliable nurseries, with no agent to come between, unless it be an honest neighbor.

As to varieties, no rule can be laid down. What we must have are the varieties that are most productive, healthy, and hardy, of high color, fair size and flavor, some of which must be good keepers.

The locality and soil will also have to be considered. But, whatever the variety or location, the soil must be strong and good.

My father was always a great lover of fruit, and among the first things he did, on coming to Livingston county, was to set an acre to apple trees. These did so well that he set six acres more in an adjoining field. When they came into full bearing he sometimes had as many as 300 barrels in a season, and one year sold the large crop at $4 per barrel. He thought if a small orchard paid so well a larger one would pay still better. So he set out ten acres more in a distant field. The soil was also distant, for in a windy time a warranty deed would not hold it. But there was an immense marsh near by, and he hoped by the use of muck and lime and barnyard manure to make the frisky sand forget its habit of dancing around and producing nothing. And the trees did grow well for a few years, came into bearing young, and produced a few light crops, then stood still a while and quickly turned into a sheep pasture. In the other orchards, set forty and fifty years ago, many of the trees are still standing

and producing some fruit. The moral is plain. Having planted sound stock and good varieties in proper soil, our work is just well begun and must be followed by cultivation, fertilizing, and pruning of the most intensive kind. The day is past and gone for successful apple-growing by letting the trees take care of themselves. Life is too short and competition too sharp to even hope to succeed by any practice which omits or neglects any one of these important points.

It would seem that these remarks were in these days almost needless; yet three of my neighbors, last spring, set peach and apple trees in their wheatfields. About five per cent. of them died before the wheat was harvested, and many more of them since.

Pruning should begin before the tree is planted, and be continued every year, thinning and shortening in so long as the branches crowd each other or make too much growth. It requires a good deal of backbone to prune properly, but no time or work in the orchard pays better for the labor. This is no theory.

And now, last but not least, spray thoroughly; and while you are spraying, sometimes omit the "s," and a kind Providence will enable us to live over again the scenes of our childhood, with our cellars full of apples.

THE FUTURE APPLE ORCHARDS OF OCEANA COUNTY.

BY BENTON GEBHART, OF HART.

The topic of apple culture in Oceana county and western Michigan calls forth our attention and needs more thorough investigation. In this day and age of modern improvements and new inventions, it becomes very necessary for us to seek improved methods in the line of successful horticulture. New inventions, with their improved processes, are incalculable in mechanical science, proper in agricultural pursuits, and quite necessary in successful horticulture. With this thought in view, I wish to fully impress in the minds of my fellow-fruitgrowers, especially the apple-growers of Michigan, the need of beginning a new era in apple culture, to advance upon a new line, with improved methods, in the culture of this most reliable fruit. Come out from under the practice of years gone by, of profitable apple-culture with no cultivation for the fruitful orchard, and of still planting the varieties which were in cultivation half a century ago, thinking they are yet valuable and able to produce abundant fruit for home use or market.

The promising apple tree, with its beautiful crops of choice fruit, does not flourish at the present day by standing in a stiff sod during a number of years without receiving any cultivation, or, still worse, when the land is seeded to some grain to take up all the moisture and fertility the soil may contain. But it can be found where good and clean cultivation is given each year, with good fertility and the best varieties. Given these

conditions, a profitable crop is assured nearly every year. Furthermore, we can continue to cultivate and grow, with any reasonable success, but a very few of the old and once famous varieties. I wish to ask my fellow-fruitgrowers, where are now the majority of our choice and promising varieties of apple, pear, raspberry, strawberry, etc., which were cultivated with profit and great success forty years ago? Truly can we say, they are not grown at present, because, in most cases, they are no more considered reliable varieties. So they have passed out of date, almost to be forgotten by the practical apple-grower of today.

It has been proven without a doubt that many of the cereals and vegetables do degenerate and become unproductive and of inferior quality. In other words, the old varieties are mentioned as having run out. While this has become an acknowledged fact in our agriculture, the same conditions exist in horticultural affairs. Especially is this the case with small fruits cultivated at the present day. Therefore, if the idea of degeneration of all fruits holds good with the apple, why not profit thereby to practice improved methods in cultivation, to seek after the few old standard varieties which are reliable and those of the new varieties which have proved to bear successful crops of fruit at the present day?

There are but a very few of the old standard sorts for market which will still bear heavy crops of choice fruit. The most promising variety with us in Oceana county, during the past two seasons, is the Northern Spy. This most excellent variety has produced double the quantity of No. 1 fruit of any other variety, for the number of trees in full bearing. It has done remarkably well in Oceana county, and perhaps nearly all over western Michigan. Nearly all the old and standard varieties of apple have suffered to a greater extent with the fungus or so-called apple-tree blight. The trees and orchards as a whole, during the last two years, have been much injured by this fungus, both in the lack of heavy foliage, growth of young wood, and failure to produce sufficient fruit buds to insure a crop, while nearly all varieties suffer more or less from the effects of blight. It also is a noticeable fact that the orchards which receive good and constant cultivation recover much sooner in vigor of growth than those which do not have the proper cultivation. The best and most reliable mode of cultivation for the bearing apple orchard, with us in Oceana county, is to give the orchard constant cultivation until it comes into bearing condition, then to seed down to clover and let this grow and remain two years. If you think you can afford to do so, let the crop of clover go back into the ground, and at the end of two years plow under the sod. Give thorough cultivation for three years, followed again by seeding to clover and plowing as before. We also are in need of some way to exterminate the codlin moth, and this I firmly believe lies in spraying, if done at the right time and with thoroughness. What we need as fruitgrowers is more practice, the getting of the process of spraying down to thoroughness. It certainly has proved very beneficial here when the proper test has been given.

The Ben Davis has shown large crops of fine-appearing fruit in some of the off years, but does not nearly equal the Northern Spy in value. The Baldwin, too, as a fair bearer of fruit, has met with some favor, but its fruit is so very wormy and foliage so liable to the blight, it is not considered of much value with us. As to the best and most reliable fall apples, the Oldenburg takes the lead of all varieties, producing large and abund-

ant crops of extra-fine fruit each season. It also is almost entirely exempt from blight. The Twenty-Ounce follows next in value. This gives some excellent crops of very large and salable fruit. It is a heavy bearer, fine grower in wood and foliage, and considered valuable.

In any locality where these varieties have done well, the best treatment of other sorts is to top-work or regraft all such which do not bear regularly and are subject to blight, to these better kinds and some of the newer varieties which I wish to mention. The method of cleft-grafting and changing bearing trees is very simple. Any one who has ever seen a scion set can do his own grafting and be successful. Trees treated in this way will come into bearing much sooner than would a young orchard of the same kinds.

As to the newer varieties, or those of later introduction, there are a number which I believe will soon prove very valuable for general orchard planting, which will bear good crops of choice fruit, and which will bring the money. Of those which have fruited and are worthy of general planting, I will first name the Yellow Transparent as the best summer apple. It is a very fine and strong grower, free from blight, an early and abundant bearer of extra-choice fruit, ripens from a week to ten days ahead of Early Harvest, and is valuable for its season. The Wealthy is a fine grower in wood and foliage, and produces some very fine, high-colored, early winter fruit. It begins to bear early and also seems to resist the blight. Gideon's Winter is another one of great promise. This is one of the strongest in growth of wood, with healthy foliage, comes into bearing very young (at three or four years from planting), bears heavily of large, yellow fruit covered with a bright red blush on one side. Its keeping qualities are good, and I consider it one of the coming apples. Sutton's Beauty also is very promising in the growth of tree and for resisting blight.

There are others which I might mention, but deem these sufficient for the present.

The future successful apple orchard will be the one of select and improved varieties, and to succeed we must plant such varieties or regraft the old orchards to those which do bear fruit; and by giving the proper cultivation and using the spray pump we may be able once more to grow the king of fruits.

SPRAYING AND SPRAYING COMPOUNDS.

BY J. N. STEARNS OF KALAMAZOO.

This is a broad subject to be covered in one short paper. So, if I but outline ideas of the work, I trust that the enlargement of those ideas may be thoroughly brought out in the discussion to follow. If I were to select soil and location for an apple orchard, just to suit me, it would be good strong soil sloping to the north. If quite rolling, it would need no tiling nor subsoiling; but there is little level land with heavy subsoil but is greatly benefited by both. This is practiced by the best orchardists and nurserymen in New York state, and is being adopted by many in our own state.

I find land that has been planted to corn or beans the previous year is in the best condition for the planting of trees. It should be plowed fully as deep as it is necessary to dig in planting the trees.

One of the important points in subsoiling is to carry the trees safely through the first season's planting, as ground so prepared will better stand continued dry as well as continued wet weather.

The best of trees for the masses to plant are thrifty two-year trees, and care should be taken in planting that the trees are not put into the ground too deep. A very good rule is not over one inch deeper than they were in the nursery, which line is easily seen by difference in color of the bark.

Never put manure next the roots of trees. I have known thousands of trees and plants ruined by so doing. I have in mind a striking illustration of this. I had sold peach trees to a certain man in South Haven, several years, and he lost nearly all of them; and what did grow were so feeble they were worthless. He said he did not know what the trouble was, as he had taken extra pains in planting and caring for them, and he knew the trees were fresh and good when he received them. I decided to go to his place to see if I could discover what the trouble was. He had but ten acres, so had plenty of time, and had fixed up a mixture of about half manure and half soil, to fill in around the roots, which, as soon as the hot weather came, were burned by the manure.

If the soil is not rich enough, put the manure around after the roots are thoroughly covered with the soil. When the soil is about two thirds filled in, if half a pail of water is poured in and allowed to soak away before filling in the rest of the soil, it will save many a tree if dry weather follows planting.

After the tree is planted it is very important that the top be headed back fully more than the possible loss of roots in digging. If this is not done, the tree pushes out more leaves than the roots are prepared to take care of, and the result is the tree's growth is stunted and does not recover in many years. I consider that starting right is the work half done, and in the end you have trees to be proud of.

I believe in thorough cultivation of the orchard so long as one expects profitable returns. If the ground is good and fertile (if not, it should be kept so by the application of suitable manure), some hoed crop may be

planted among the trees for several years; but in this I make it a point never to plant nearer than four feet to the trees. I find beans the best crop to plant in young orchards, as the right cultivation of them is seasonable for young trees, cultivation ceasing in time to give the trees ample time to ripen before winter. The next best crop is corn. Never plant potatoes in a young orchard, as stirring the soil in digging the crop stimulates a late, soft growth, to be injured by winter. By all means never plant the orchard and sow in grain, unless you wish to throw away so much money and have a continued reminder of your folly.

Trees need but little pruning if attended to yearly, cutting out small limbs that are likely to be thick and crowded as they grow. I find it necessary to do most of the pruning and some shortening in on the east side of the trees, to keep them properly balanced, as our prevailing winds are westerly.

The selection of varieties depends quite largely on the soil on which they are to be planted and the object of the orchard, whether mainly for home use or for market. We have some varieties that do fairly well on any good soil, while some others of our best apples are unsatisfactory unless planted on soils just adapted to them. As an illustration, the Rhode Island Greening, every one knows, is of the very best and always brings the highest price when well grown, but is not profitable unless planted on the best strong soil. I have frequently replied, when asked the question, what would you plant in planting 1,000 apples on a place on which there was no apple orchard, "I would plant one half Wagener, and would plant these between trees planted for permanent orchard, or on ground I might want in the future for some other purpose, and would plant them twenty feet apart to obtain best results." The Wagener is a fine apple in quality if kept well pruned, so as not to set too much fruit, for, as usually managed, it will bear itself to death before the Spy and Greening begin to bear.

For a summer apple I know of none equal to one originating in Kalamazoo something over twenty years ago, with Mr. McSweeney on Park-st. It is a seedling of the Sweet Bough, which it much resembles in appearance, but is very tart and is the best cooking apple of which I know, being much superior to the Astrachan in bearing qualities, bearing very young and producing good crops every year, while the Astrachan only bears alternate years. The past year was an off year for apples, but I had trees of this sort on which limbs were broken with the load of fruit. We call it McSweeney. I began propagating it some fifteen years ago, and now it can be found in either of the nurseries in Kalamazoo, but I am not aware that it has been propagated outside of the county.

Oldenburgh, Gravenstein, and Maiden's Blush are reliable fall apples.

Among some of the best winter apples that succeed on medium soils are Wagener, Hubbardston, Grimes' Golden, Northern Spy, and, for extra-strong soil, Rhode Island Greening, Jonathan, and Shiawassee Beauty.

The Baldwin is losing some of its former popularity for market, on account of the bitter spots under the skin. In the east, Sutton's Beauty is taking the place of it, being a good, strong grower, of good size, and bright red. For sweet apples, Talman and Bailey's succeed well.

For extended planting for market, of varieties that have been well tested in this state, where soil is favorable, I think the following will be found to pay the best with intelligent management: Spy, Rhode Island Greening, Jonathan, and Hubbardston. These are all apples of good quality. I

would plant none of the poorer quality, like Ben Davis, Cooper's Market, Limber Twig, Flushing Spitzenburg, etc., although they succeed well, and when well grown are fine to look at; but you will have to sell them for about one half what the better apples mentioned above will bring.

Of course the orchards should be closely watched for all destructive insects and fungi, which may be easily warded off by the application of the combined Bordeaux mixture and Paris green.

Mr. R. M. KELLOGG said that in his judgment the real cause of the failure of the orchards had not been stated. It is, of course, the result of a cause, and that cause began its operation thirty years ago in excessive pruning. In those days they also picked the leaves off from grapevines, not understanding the fact that we can not seriously disturb the balance between top and roots without doing perhaps permanent harm to the tree or vine. Excessive pruning has deranged the whole system of the trees, preventing proper assimilation of the sap. When trees have been weakened they are attacked by every fungus and insect known to their life. Later on, the apple was weakened by bad methods of propagation. Nursery stock should be budded from bearing trees, yet there is now scarcely a tree-grower but propagates by buds from nursery rows. Such buds do not transmit the vigor which comes from the buds of mature, strong, bearing trees. The nurserymen are propagating for money only, not caring whether the orchardists get any fruit. I have been offered apple trees at $3.50 per 100. They can not be grown for that price, at the present rates of labor, if grown as they should be. We might as well try to renew an old animal as an old tree. Get trees on good, hardy stocks. Mr. POST of Lowell got seedlings from Mann, Ben Davis, and Janet, and grafted them low in the root, then topgrafted them and so got a good foundation for his trees, and I feel sure he will succeed. Mr. KELLOGG related how he had seen four men, at different times in the same forenoon, in Rochester, N. Y., buy of a man four different kinds of apple tree from the same load, the owner each time declaring the entire load to be of the variety wanted by the purchaser. So long as our stock is taken from old beds, canes, and such apple trees as these, so long will we continue to enquire, "Why don't they grow?" I am going to set a new apple orchard, and do all the good things recommended, and I expect to grow rich from it!

Prof. L. R. TAFT: I am glad to endorse what Mr. KELLOGG says, in many respects, but in some things he is wrong. He has some wrong ideas as to scions and stocks. It has been said that Mr. POST used hardy wild crab stocks, but he denies having done anything so foolish. While scions from the nursery row grow faster the first year or two, than those from

bearing trees, they do not do better afterward. Nurserymen often use too short roots, though we have found that the second and third cuts usually do well. Many of them use nursery scions, but many others do not. Some are rascals, but not all. Order trees direct from nurserymen whose standing you know, and buy only first-class stock.

SEEDS.

BY PROF. W. J. BEAL, MICHIGAN AGRICULTURAL COLLEGE.

Of all the scientific definitions of a seed that I have found, none suit me better than one mentioned by W. W. TRACY of this society, who knows, probably, more about seeds, in a commercial way at least, than any man in Michigan. It runs as follows: "A seed is a plant packed ready for transportation."

To secure good seeds with a substantial genealogy (and seeds have genealogies as well as men) which shall go far toward securing uniform good plants, true to breeding and name, we should go back several generations. As Dr. O. W. HOLMES said, with reference to the training of a child, he would begin with its great-great-grandmother.

When very young, a seed is called an ovule, and is usually situated in the midst of a flower, which contains male and female parts. The position of ovules, in the ovary, and their structure, are here illustrated. We have to be exact in our botanical terms, using each in its own peculiar place. The leading object of a plant is to reproduce itself by seeds or spores—at least, of most plants. To get ready for reproduction, the parent plant must grow for a season or more, to acquire size and strength. After flowering, food is carried to the young seeds to build them up, and a surplus is added for a start in the world when cast off or left to shirk for themselves.

The external markings of seeds, their shapes and colors, are truly wonderful, and in many of these points there can be found an advantage to the plant. Seeds are often surrounded by a pistil or fruit, which is red, white, yellow, or otherwise conspicuous, and this attracts mammals, birds, or even frogs and fishes, as much as to say, "Here I am, pick me up and give me a lift on my journey." Many seeds found in edible fruits have coverings so hard and thick that they pass undigested through the alimentary canals of animals. Some seeds and small fruits are carried by the wind, aided by wings or a downy substance, while others hold to animals by means of hooks. Some float upon the water.

Seeds are composed of small cells, mostly filled with food in a condensed form. In case of beans, peas, squashes, acorns, etc., nourishment is nearly all stored in two large seed leaves, while others, like Indian corn and buckwheat, have much reserve food stored outside or around the seed-

leaves. Here are illustrations of seed-like fruits, most likely to be mistaken for seeds. They are small fruits, containing a seed inside. Of such are all of our true grains, like wheat, corn, rye, oats, rice and barley; also the seed-like germs of the dandelion, thistle, and sunflower; of buttercups, maple, elms, chestnuts, and acorns.

Fruits usually have one or more jackets or coats over their seeds.

The most wonderful thing in every seed is its living protoplasm, which may remain dormant, ready to manifest itself in growth, after a long period of rest, whenever all the conditions are favorable. The food of seeds is starch, aleurone, protoplasm, cellulose, inulin, oil, etc. Here were shown some of the forms of granules of starch as seen in potatoes, wheat, barley, corn, buckwheat, euphorbia, and other plants. A study of these is necessary to enable one to detect adulterations in many kinds of food.

Heat, moisture, and oxygen swell the seed and start it to growing. Complicated changes take place in the food materials.

In getting out of their coverings some seeds perform queer antics, very interesting to study.

The food stored inside the seed-leaves, or at one side or surrounding the young plant, gradually becomes soluble and is all used. The substance is absorbed by the young plant on all sides, and not through any special mouths or organs. The young plant fairly rolls in the fat of the land.

In germinating barley, for example, the cell walls of the endosperm near the embryo disappear gradually, further and further out, disintegrating the starch which slowly turns to sugar.

The cellulose of the cell walls is dissolved through the agency of a ferment called diastase, analogous to the changes produced on milk by the rennet in the stomach of a calf.

I quote from the Journal of the Royal Agricultural society of 1890, page 508:

In the barley, the ferments are formed in the matrix of protoplasm. Besides giving rise to the ferments, the protoplasm is the seat of other chemical activity, processes of gentle oxidization and reduction taking place there as long as it is living. The barley grain, then, contains a living embryo, surrounded by a store of reserve food materials which can be called into the nutritive processes only by the action of the embryo, which has, in part, to secrete the ferments necessary for the digestive processes. These changes comprised in germination are set up only when the seed is exposed to moisture and warmth. Why is it necessary to thus wait? Why should not the changes in the reserve materials follow at once on the maturity of the seed, and so cause the growth to go on without any resting period? The answer to this turns on the condition of the ferments in the resting seed. If these were in an active condition there, as they are in the germinating seed, there would seem to be no reason for the suspension of activity. The ferments do not make their appearance till termination begins, and the commencement of this process is really dependent on their development. From what do they arise? The ferment is in the cells of the seed, but not in active condition. To put it in other words, the seed, before germination, contains in its cells something, which, though not the active ferment, can be readily transformed into it by warming with a little weak acid. To this something, which can be extracted from the resting seed as easily as the ferment can be from the germinating one, the name "mother of ferment" or *zymogen* has been given. The resting seed, therefore, differs from the germinating one in containing zymogen instead of ferment. On the outset germination is brought about by the conversion of the former into the latter. The condition of the resting seed is neutral, neither acid nor alkaline, whilst the contents of the cells are dry. The change in the reaction of the seed, from neutral to faintly acid, can be easily seen. The vegetable acids so formed convert the zymogen present in the cells into the active ferment, and at once the conversion and transportation of the nutritive materials toward the seats of growth or of absorption set in. The reserve materials are insoluble, but are changed and made soluble during germination. The young plant absorbs and uses the decomposing or changed reserved food.

We now know that the food of the embryo of a plant is as complex as that of an animal; that besides starch it may comprise very many kinds of carbohydrates; that nitrogen-containing matter or proteid is an absolutely essential constituent of it, occurring in some form in all seeds; and that very many plants accumulate various fats or oils for the same nutritive purpose.

The embryo or young plant, then, finds itself provided for by its parent, shielded from the adverse influences of its environment, if such there be, by being wrapped up in a strong protective integument; situated in the midst of plenty of nutritious material, and furnished in itself with all needful powers of calling these supplies into active use as soon as changes in its environment supply to it the necessary stimulus to its development and growth. The whole process of germination, indeed, is one which is strictly comparable with that which goes on constantly in the animal body, viz.: digestion and the absorption of the products of digestion.

When this reserve food is gone, what then? The thing is no longer a seed, but has become a seedling. It has, in case of our cultivated higher plants, acquired chlorophyl in its protoplasm—has become capable of elaborating and assimilating the crude materials taken from the air, the water, and the soil, and using them to build up itself.

A chapter may be written on the impurities contained in seeds of grasses and clovers, such as dirt, chaff, stones, seeds of weeds. The latter are carried by man and sown by him in good soil well fitted to sustain growth.

Another chapter could be written on the best modes of preserving the vitality of seeds, showing that there is no one best way for all sorts of seeds. Chestnuts, acorns, walnuts, must not be thoroughly dried, while this is just the thing for beans, mustard, and wheat.

There are some queer things about the germination of the seeds of many of our worst weeds. Fourteen years ago I buried seeds of some twenty kinds of weed. After ten years one set was tested. They were in a bottle of moist sand, twenty inches below the surface. The sand was taken in spring into the laboratory and kept slightly moist, when at once many seeds began to grow. Alternations of moisture were kept up till late in November. During all of this time seeds sprouted more or less abundantly. I set the sand away dry and in a cold room, all winter, when the next spring, warmth and moisture were applied. At once some seeds sprouted, and others kept coming on slowly for some weeks. Why did not all the seeds start during the first few days after they were taken to the laboratory? We can not answer. But this we see, that the difference in time of germination is a great benefit to such species of weeds, for a new crop may appear, if accident destroy the first.

Seeds of wheat and buckwheat may often be sprouted five to seven or more times before being exhausted. In these cases the root is the part starting. The tip dries up and dies, and when again moistened pushes out one or more sprouts at the side. The terminal bud in each case starts more slowly and is not killed till the final drying is made. If killed, no branches appear.

Seeds of some plants are sown or scattered by quickly bursting pods. Samples may be found in the wild touch-me-not, peas, witch-hazel, and oxalis.

Seeds are often buried or covered by the falling leaves in autumn. They work into cracks in the soil, by means of the motions above referred to; also by twisting awns as in some of the grasses. Water carries many into small crevices and washes soil over them. In case of the grains of porcupine grass, they bore or twist themselves into sand for several inches, or

even bore through the skins of sheep and dogs, causing them much annoyance.

There are a host of little "ear-marks" on the outside of a seed, as well as inside, which the botanist must understand to enable him to separate one kind from all others and give it a name. Comparisons of the seeds in question with some known to be true to name are often made. Seeds can usually be easily tested for vitality by placing a thick, wet cloth or blotting paper on a plate, with another plate turned over it, watching it for a few days, in a warm place, to see that it is not kept in water, nor allowed to dry.

The most valuable seeds of farm crops and garden crops, and of some plants grown for flowers, have a pedigree, or might have one, like those of our choicest horses, cattle, or sheep.

Plants are improved by cultivation, by changes of environment, and these selections are made for some generations, where propagated by seed. Crossing of the flowers is afterward resorted to.

The above is only a synopsis, prepared by Dr. BEAL, of his extended lecture, which was illustrated by use of numerous charts of botanical specimens.

SELECTING SEED CORN.

Mr. W. W. TRACY followed with remarks concerning seed-breeding. Upon nine tenths of our farms, he said, the product of corn could be increased 5 to 21 per cent. by a day's work each season in selecting seed. Animals differ in their ability to transmit their qualities to offspring, and it is not always the best animals which can best transmit their qualities. The same state of things exists among plants, and the same differences among seeds of the same plant. In my work I may find in an acre of tomatoes three plants bearing more fruit than others. I save these and plant them. The product of two may be no more than the average of the field, but the third plant may give very markedly better fruit than that of the original or any of the three, increasing both the quality and the quantity. Each farmer here should select, this winter, five or ten ears of corn which he thinks meet his idea of his wants, his soil, etc. First think what this type of corn should be, note down the requirements, and then make the selection. Next spring plant the corn in a corner by itself, in squares, ten hills each way, from each of the ears. Go through the center of each plat in the autumn, and you will be surprised to see to how great an extent the product comes up to the ideal. Select ten ears again from each plot, and compare the several lots. Plant from the plot which furnished the greatest number of ears. Again take the best, propagate the next year in the same way, and so on till you have enough seed to supply a whole field. You will find a 20 per cent. advance in yield over

any seed you can buy. There will have been only a little extra labor, while the direct benefit will be great, besides the pleasure derived.

In answer to a question, Prof. TRACY said there is no difference in the value of the grains of corn upon the same ear. It is the potency of the plant, not the size of the grains or fruits, which determines the matter. In this Dr. BEAL concurred.

CAUSES OF SUCCESS OR FAILURE IN FRUITGROWING.

BY C. P. CHIDESTER OF BATTLE CREEK.

I have had some very dearly bought experience, and if I can feel assured that by giving it to others I can prevent them from making some of the mistakes I made, I shall feel that the duty we owe each other has been partially performed.

When we see how prominent a place fruit occupies in the economy of nature, and how much care and attention are given to its cultivation and improvement, we believe a wise Providence designed that we should use it in every way conducive to our health and happiness.

The value of ripe fruit in preventing disease and promoting health can hardly be overestimated. Ripe fruit is one of the greatest blessings nature bestows upon mankind, and the pleasures and benefits to be derived from its use should be more forcibly impressed upon the minds of our people. Apples, in the years past, used to stand at the head as the most useful kind of fruit. But their widespread failure during the last few years has led the horticulturists all over our country to enquire for the causes which have produced this failure. The sales of apples in Michigan, in 1888, amounted to over three millions of dollars. When we consider that vast quantities of other kinds of fruit are produced in Michigan, we can readily see that the fruit interest ranks well with other interests of the state. While in the aggregate the amount of fruit shipped from this state is very large, it must be evident to most of you that success in fruitgrowing is far from being general among the farmers of this state. All who have lived here forty years can look back to the time when apples, peaches, and plums grew almost spontaneously over the inhabited portions of Michigan.

But what a change has taken place! The fact is, nearly one half of the farmers in certain localities have to buy these fruits or go without them. Now, there must be reasons why we can not grow fruit to the same perfection as in former times. There are three main reasons, in my estimation, why fruitgrowing so often proves a failure. The first and greatest cause of failure is insufficient protection by a lack of windbreaks. The second is insufficient protection against fungous diseases and insect enemies. The third cause is the lack of proper fertility in the soil. There are

secondary causes which sometimes seriously affect the success of the fruitgrower, among which might be named improper location, lack of cultivation, and improper pruning.

This question, the cause of the failure in apples, was discussed at great length at the farmers' institute at Adrian the last week in January by some of the leading horticulturists of the state. Every conceivable theory of cure was advanced, including spraying, fertilizing with ashes, different modes of cultivation, and some even attributed the causes of failure to fruit tree peddlers. Failures have been noted under all kinds of treatment, thus proving that the great cause has not been found. President Horton, in summing up the question, said: "The question is, are we justified in planting new orchards? I confess I am discouraged." He said he had thus far seen no answer to this question that would lead him to invest in a new orchard; that he had 200 trees, Baldwins and other varieties. It should be an orchard in its prime, as it is twenty years old, yet it has never had enough apples to pay interest one year on the investment.

I ask no farmer to adopt the theories that I advance for the increased failure of fruit during the last few years, unless they are found upon investigation to agree with the laws of nature scientifically applied Should the causes here given meet your approval, the sooner they can be carried into effect the better. As before mentioned, I consider the greatest cause of failure in apples and peaches is due to the exposure of orchards to the prevailing winds during the winter season. In my opinion there is no subject of so vital importance to the fruitgrower, or one that so imperatively demands his attention, as windbreaks or shelter to his orchards and fruit gardens. All who are acquainted with foreign horticulture are aware that the principal gardens and fruit grounds are surrounded by walls or hedges, which show that orchard and vineyard protection is calculated to be very essential if not absolutely necessary to success. Any one who will take the trouble of observation can be convinced that where orchards are protected by windbreaks the fruit attains a greater degree of perfection. It is also true that trees so located are much less liable to disease than those in more exposed situations. It will often be noticed that trees of tender varieties often thrive and bear well in such sheltered locations, while the same varieties in more exposed locations would not succeed at all.

It is an established fact that many of our best varieties of fruit trees are more liable to disease, and the fruit generally of inferior quality, as compared with former times. Even if we should admit that much of this inferiority is produced by the increased age of our orchards, as well as neglect in other respects, it can not be denied that, even with our improved knowledge in cultivation, many fruits are not produced in such perfection as formerly, with what would now be called unskilled labor. I think the facts will warrant me in making the assertion that, taking all parts of our state where orchards have no protection from the winds, it is a very rare occurrence to find them producing fruit of any worth as compared with former years. On the other hand, it is equally true that where our orchards are well protected and receive the proper care they have produced paying crops until the last two years.

Our orchards were visited, during the time the trees were in blossom in 1892, by a storm of unusual severity, which destroyed nearly all the fruit blossoms. The orchards in 1893 had but few blossoms, probably

owing to the excessive number of blossoms of 1892. That year and 1893 being exceptional years, no account can be taken of them as a basis for calculations in the future. Now, the question naturally arises, to what shall we attribute this great difference in the productiveness of orchards in the same latitude, if not to the absence of wind protection? Since the natural windbreaks have to a great extent been removed, it now remains for us to provide the necessary protection by artificial plantations.

The Norway spruce is probably better adapted to this purpose than any other evergreen. A timber belt from four to six rods wide, planted twelve feet apart, upon the south and west sides of an orchard, will in a few years form an efficient protection.

It is the province of man to assist nature in producing such results as he finds most desirable for his purposes, and if he removes the natural protection from his orchard, and then leaves it to take care of itself, he must expect to realize the usual consequences of neglect.

As before stated, the second great cause of failure in fruitgrowing is insufficient protection againt insect enemies and fungous diseases. I am firmly impressed with the belief that the future success and profit of apple-growing will greatly depend upon our success in protecting our apples from the injury done by the codlin moth. The experiments during the last few years have clearly demonstrated the efficiency of London purple and Paris green for the destruction of this orchard pest. I am satisfied from my own experience that the use of the arsenites in connection with Bordeaux mixture is much to be preferred to using them with water only, for the reason that the poison very seldom injures the foliage when used in connection with Bordeaux mixture. I was very successful last season in saving my plums by spraying with the following mixture: Four pounds stone lime, four pounds sulphate of copper, one quarter pound of London purple or Paris green, and fifty gallons of water. Spray just before the trees blossom and again as soon as the marks of the curculio are noticed. I was also successful in preventing the black rot on my grapes by the use of the above mixture without the addition of the arsenites.

The third cause of the failure in fruit is a lack of proper fertility in the soil. We can not expect to raise good stock or good crops without giving the proper food and care. The same rule holds good in growing fruit. With the proper knowledge of the principal ingredients of which fruits are composed, we are enabled to supply to the soil that which is required for their perfect growth and development. We have learned by analysis that the wood of the apple tree contains 18 per cent. of lime, 16 per cent. of potash, and 17 per cent. of phosphate of lime. The natural conclusion from the above analysis would be that that which would be called a limestone soil would be the best suited for orchards and vineyards, and wherever deficiency of lime exists in our soils we must supply a liberal amount of lime, ashes, and barnyard manure. It is a well-known fact that fruit trees or vines that are properly nourished produce more and better fruit, and that they are less likely to be injured by insects or diseases.

For fear of trespassing upon your valuable time, I have only treated upon a few of the most important topics relating to horticulture. I would say in conclusion that, in looking over the state and seeing the dilapidated condition of our orchards and fruit gardens, and realizing the great increase of our insect enemies; also, noting the destructive climatic changes which have taken place by reason of our indiscriminate destruc-

tion of timber belts during the past few years, it seems to me necessary that we become better educated in the science of horticulture if we would become successful fruitgrowers. Taking the above facts into consideration, how important it is that we cultivate, cherish, and protect these delicious fruits which have been placed in our charge and for our use, to refine our tastes, increase our happiness, and to better prepare us (morally, physically, and intellectually) for the important duties of life.

Mr. L. W. Wilton said he would not cultiavte an apple orchard after it was ten years old. "One hundred of my trees 1 have cultivated, using a rotation of crops, while the rest have been mulched and supplied with ashes at the rate of four to five bushels per tree per year. I am well satisfied that it is detrimental to trees to cultivate them after the tenth year. The 100 trees gave me but little fruit, while the others have not missed a crop in twelve years.

QUESTIONS AND REPORTS.

THE QUESTION-BOX.

Are coal ashes of use as a fertilizer, or to soften clay soil ?

Prof. L. R. Taft: They are of no use as fertilizer, if they are all of coal and no wood; they contain neither potash, nitrogen, nor phosphoric acid; they do lighten, make porous, clay soils.

Mr. T. C. Pierce: At a meeting a few years ago, a professor said coal ashes were of no value; but one year ago last spring I put corn and oats into a box containing only coal ashes, and both matured.

Prof. Taft: There may have been some wood ashes mixed in, or the roots may have passed through the box and into the ground.

Mr. Pierce was sure that neither of these things were the fact, but said the product was not normal.

A voice: Would you take home ashes which were two thirds coal and one third wood?

Prof. Taft: Yes, I would; and they are worth going after two or three miles.

Mr. W. W. TRACY: In cities, bones and garbage are burned in the coal fires, making the ashes the more valuable.

Is salt good as a fertilizer, or to retain moisture for the blackberry?

Mr. TRACY: Salt affords no plant food; yet it seems to have some good effects, but it is not known exactly how. Salt and plaster on clover have been known to produce good results.

Prof. TAFT: If you have cheap, refuse salt, it is well to apply it; but, as for moisture, I would depend upon shallow cultivation rather than upon salt.

Mr. DANIEL STRANGE: Would it not effect such chemical changes as to make available more or less of the potash in the soil, which is not in condition for assimilation by plants?

Mr. CROZIER thought not.

Prof. TAFT: Mr. STRANGE is right as to there being large quantities of potash in the soil, unavailable for plants, but salt would be of little benefit in liberating it.

Mr. R. M. KELLOGG: I have been told it is effectual against cutworms, but have found it of no use in this respect.

Mr. HALL: Will it not exterminate the grub from clover? I have found it beneficial upon clover and potatoes in extermination of grubs or preventing their attacks. I used it in the hill, keeping it away from the seed.

Mr. WALKER: I have had good results from the use of salt upon light soils.

Mr. CROZIER: Is not the benefit more from the impurities in refuse salt than from the salt itself?

What are the best three varieties of red raspberry for market, coming ahead of Cuthbert?

Mr. S. R. FULLER: Hansell is the best I can grow upon my heavy soil with clay sub-soil.

Mr. KELLOGG: Crimson Beauty does well with me. It is pistillate and must have other varieties near it. Hansell is not so vigorous as it should be, save upon very heavy soil. But Hansell is the best early red berry I ever grew.

While neither Mr. KELLOGG nor Mr. FULLER liked Marlboro, Mr. GREEN said he gets double the amount of fruit from Marlboro as from either Shaffer or Cuthbert.

What is the best treatment for the apple-tree borer?

Prof. TAFT: If the borers are already in the tree, dig them out with a pointed knife or wire. One preventive is cultivation, keeping the grass

away from the trees. Wash the trees with diluted soft soap with a little Paris green in it. Lime is of no use in itself, but will help hold Paris green, which may be applied in form of whitewash. Borers come of eggs laid by a moth. Keep the bark smooth and there will be fewer places for deposit of these eggs. Paper may be wrapped around the trunks, and under this the eggs will be placed, when they may be destroyed. The washes should be applied in late spring or early summer. But, though these will in some measure prevent the laying of the eggs, or destroy the larvæ before entering the tree, do not rely upon them, but dig out the larvæ wherever they may be. The rough bark may be rubbed off, but this must be done lightly, because damage will come of exposure of the green bark. Washing will tend to give smooth, healthy bark.

Prof. G. C. DAVIS answered several questions which were asked or had been previously referred to him, at conclusion of his paper on " Insects and Insecticides." The first of these related to the squash-vine borer. Several insects and a fungus, said Mr. DAVIS, attack the squash vine. The borer gets into the pith of the vine, near the roots, and works backward toward the root. It is a serious pest. The fungus acts in the same way. Very little is known of it, and there is no known remedy for its ravages. This fungus is carried about by the little striped beetle. Carbolized lime dust will keep this beetle away from the vines, and the borers may be kept away by corncobs dipped into tar (coal tar is best) and laid among the vines. If summer squashes are planted among the winter varieties, the eggs of the borer will be laid among the former, which may be pulled up and burned, and the borer so destroyed.

Mr. R. M KELLOGG asked Mr. DAVIS if he had had any experience in treating moles with bisulphide of carbon. Mr. DAVIS said this gas might reach the mole, but his burrow is along and near the surface, so the gas would be likely to escape before affecting him. I know of no poison which is effectual against moles.

Asked as to strength of washes of lime and Paris green, for use upon fruit trees, Mr. DAVIS said he used enough of the arsenite to show a green color in the mixture.

Stone fruits should be sprayed both before and after the blossoming. No harm would come to bees in either case.

Mr. C. P. CHIDESTER: I have sprayed my grape vines when in bloom, and no harm came to the fertilization. I spray plums first just before the blossoming, and again when the work of the curculio is shown, using four pounds each of lime and copper sulphate in fifty gallons of water, with one fourth pound of London purple. I believe this will kill the larvæ of the curculio.

Mr. DAVIS: The clover-root borer is an annual insect, making three changes of form each year, all in the clover. No remedy for it is yet known which is effectual. Rotation of crops will probably have the best results of any method of dealing with it. The egg is very small, a quarter the size of a pinhead, is white, and is laid in the stem; it hatches in ten days into a white, footless grub, which burrows in the roots; in the latter part of summer these pupate, turning from white to brown, and then change into the beetle state. This form of the insect is quarter of an inch long. It feeds upon the roots, as did the grub, and lays eggs which hatch again into the larvæ described; but whether the eggs are laid in fall or spring is not yet known. Wet or dry weather seems to have no effect upon the insects save as it affects the growth of clover.

Mr. L. D. WATKINS said he had had a new forty-acre field of Alsike clover wholly ruined by these borers.

REPORT ON EXHIBITS.

The committee on exhibits would report that they find on exhibition a number of good specimens of several varieties of apple. Considering the almost entire failure of the apple crop the past season, it certainly shows that apple-growing is not a lost art in Eaton county. The apples were for the most part of large size and free from scab and the apple worms, which we understand is due to spraying.

The largest collection of apples is shown by M. H. BAILEY of Windsor, and consists of Baldwin, Talman, Fallawater, and Bellflower. A remarkably fine plate of Northern Spy from MICHAEL MERKLE of Eaton; of Ben Davis from L. W. WILTON, and Fallawater from H. P. HAYES of Benton, deserve particular mention.

Several other plates of apples were noted, but your committee were unable to learn the names of the owners.

C. P. CHIDESTER of Battle Creek shows a plate of Chidester's No. 3 seedling black grape. Both bunch and berry are of a large size, and it seems to have unusual keeping qualities.

We notice also a photograph showing several trusses of the Conrath black raspberry, now being introduced by CONRATH BROS. of Ann Arbor. The berries are of large size and quite numerous upon the trusses. It seems to be promising as a large early black-cap.

R. H. WARREN exhibits a parsnip the size of which indicates that the soil of Eaton county is well adapted to the growing of roots.

One of the most interesting exhibits was the collection of adulterated vinegars and jellies, shown by Dr. KEDZIE of the Agricultural college. From his statements of the results of his analyses, and the tests made in the presence of this society, we would urge that, as individuals and as a society, every possible means be employed to arouse a public interest that will secure a law to control the sale of such and other adulterated articles of food. Not only should the injurious effect upon the health of the consumers be considered, but the fact that the sale for the pure-fruit products

is almost destroyed, except at prices that will not pay for handling the crops, should stimulate all farmers and fruitgrowers to their utmost efforts to protect themselves.

L. R. Taft,
Will W. Tracy,
C. W. Shriver.

RESOLUTIONS.

Resolved, That the members of the Michigan State Horticultural society hereby tender their sincere thanks to the members of the Eaton County Agricultural society for the hearty welcome and numerous courtesies so freely bestowed upon us;

That our thanks are due, and are hereby tendered, to the citizens of Charlotte, for the liberal hospitality which we have enjoyed at their hands;

That we also tender our thanks to the editors of Eaton county, who by their presence and influence have added so greatly to the success of this meeting.

Our thanks are also due to the city government for the use of this beautiful hall for our meeting at this time.

We also thank the musicians who have added so greatly to the enjoyment of this meeting.

R. M. Kellogg,
L. W. Watkins,
C. P. Chidester.

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PROCEEDINGS OF THE SUMMER MEETING.

HELD AT SOUTH HAVEN, AUGUST 21 AND 22, 1894.

A VISIT to South Haven is always a pleasure to the fruitgrower, the more so if he goes in the growing or fruiting season. Those who went there upon attendance at the summer meeting of the Michigan State Horticultural society found no exception to the rule, if, indeed, they did not find the pleasantness of the place and the hospitality of the people a little more tangible and hearty than usual. There were far more visitors than could reasonably have been expected under the circumstances, enough to make, with the local attendance, large audiences at each of the sessions. It had been planned to have the meeting a little in advance of the middle peach harvest, but the dry, warm season, hastening the ripening, caused the interference which it was hoped to avoid. The visiting attendants mostly arrived the morning of the 22d, though a few were on hand sooner, and were received at the station by a committee with carriages, who took them at once to the experiment station. The company included Gov. RICH, Pomologist HEIGES of the national department of agriculture, Profs. TAFT and DAVIS of the Agricultural college, and a number of other gentlemen from different points in the state.

At the station, which is under the careful superintendence of Mr. T. T. LYON, everything was found to be in perfect order, the trees and plants showing as good a state of cultivation as could be wished, while growth and fruitage were as good as could be expected under the conditions of the season. A trip about the grounds was made by the large party, who found very little to criticise and very much to commend. The visit was made chiefly to the pear, plum, and grape plats, as the peaches, like all others so close to the lake this season, were not in bearing. But the trees

were in healthy condition, giving proof of proper care. Everywhere the benefits of spraying were distinctly visible in perfectly healthy foliage and fruit.

Leaving the station, the party were driven through the plantation of Mr. J. N. STEARNS, than which it would be hard to find, in Michigan or any other state, one more perfect in all points. Peaches were scarce here, too, but the pears and plums were the very picture of abundance. The trees had been well watered, upon a plan afterward detailed by Mr. STEARNS, at one of the sessions, and the beneficial effect of the irrigation was plainly discernible. So loaded were the pear trees that much loss and injury would have ensued had they been left to the chances of rain. The varieties in bearing were Anjou, Louis Bonne, Bartlett, Angouleme, Clairgeau, and perhaps others. Of plums there were at least Bradshaw, Lombard, and McLaughlin, and of these the visitors were permitted to help themselves freely. As Mr. STEARNS cultivates a full line of Michigan fruits, and gives each and all the very best of care, the man who is seeking the best knowledge obtainable of cultural methods could nowhere become better informed. Mr. STEARNS is one of the comparatively few men whose practice is in all respects quite equal to his advice to others. This fact is one of the secrets of his great success in both orchard and market.

The other orchards seen in passing seemed all to be in good condition of tilth, though the fruitage was light, so far as peaches were concerned, while apples showed in most cases a third crop or less. Pears were everywhere abundant and remarkably free from scab, even Flemish Beauty being in fine order in this respect. The same seems to be true throughout the state, without regard to spraying. This is the more remarkable, considering the prevalence of scab on the apple and the susceptibility of Flemish Beauty to this disease.

The first session was held in the fine oak grove on the north side of town, but it was comparatively brief, the company not assembling till about eleven o'clock.

Adjournment was made for dinner, which was served in horticultural hall, a large building erected by the local society, in the grove, and great was the abundance and the toothsomeness of the repast. This charming form of entertainment was repeated next day, there seeming to be no limit to the supply of delicacies and none to the generosity of the hosts.

After dinner, from two to three hundred people answered President MORRILL'S call to order and listened to music by the ladies' band of South Haven. It is a cornet band, composed almost entirely of ladies, who show no little skill in their renditions of the usual style of brass band music. The fruitgrowers had the pleasure of their entertaining efforts at several

others of the sessions, and the thanks they expressed in their final resolutions were very far from being the mere formalities such resolutions sometimes are.

ADDRESS BY GOV. JOHN T. RICH.

The chair presented the Hon. JOHN T. RICH, governor of Michigan, who for a half hour or more interested the audience in a review of some of the sources of the state's good fame. He could not discuss horticulture, he said, because all present were experts in the art, while his experience as a farmer had been in altogether different lines. This is a region not better in soil than many others in Michigan, but in it has been developed the business of fruitgrowing, and its inhabitants are much the better off in consequence.

Horticulture is of great advantage to a community because it affords a great variety of employment in the industries dependent upon it, as well as in production of the fruit itself; and it does not so extensively, as does general agriculture, enter into competition with itself.

I have hoped to see the time when this country produced all the sugar necessary for its own consumption, whether from beets, sorghum, or the sugarcane. It ought to be done. I still believe it will be done.

Mr. RICH proceeded to speak of the broad and generous policy which was adopted by the founders of the state, a policy the subsequent enactment of which has made the state government and institutions second to none in the Union. He mentioned the great university, the normal school, the Agricultural college, the mining school, and the system of common schools, and said the state not only made generous donations of lands to the support of the educational institutions, but a share of the specific taxes as well, so that a round million each year is turned into the fund of the common schools, a sum equal to two thirds of the entire state tax. This aid to the schools can not be diverted from them, for the fund is not in the form of commercial loans, but is held by the state, which puts the principal back into the pockets of the people, who well can afford to pay interest to such an object as this. Besides this, the state cares for the insane and educates the deaf, dumb, and blind. The former must be done for simply the sake of humanity, while the latter is a good investment for the state, because it makes these poor unfortunates self-supporting instead of dependent upon the state as otherwise they would be. Then, there is the industrial school. This was at first called a reform school, and was but little different from a jail. Now all traces of the prison are removed from it, the name changed, and the boys treated as worthy of confidence, as being worth saving. Although they are originally sent for some offense or

other, they are often more sinned against than sinning. This is also a good financial investment for the state, for the boys are saved from lives of crime. The school for girls at Adrian is equally good for the same purpose.

The state has invested in these institutions $10,000,000, and expends two million dollars per year for their support. They are managed by boards composed of some of the best men in the state, who serve without compensation and are willing to sacrifice their valuable time for sake of the welldoing of their work.

Then, too, there is the insurance commissioner, working to keep the people from loss from unsound insurance companies. The railway commissioner stands for the rights of individuals in controversies with railway companies, giving them help which they could not otherwise obtain, for the average man is ill prepared to cope with a corporation in maintaining his rights. The inspector of illuminating oils engages to protect the public from the sale of unsafe illuminating oils and from the explosions and accidents which otherwise would be frequent. The commissioner of labor collects most valuable statistics of the state of labor in the commonwealth, ascertaining conditions, a knowledge of which is essential to wise legislation concerning workingmen and their needs and rights.

I congratulate you upon your success as horticulturists, but still more upon your condition as citizens of this grand state, whose interests are yours, and to guard which and to do your portion toward making this a model government is your sacred duty.

ADDRESS BY POMOLOGIST HEIGES.

Prof. S. B. Heiges, pomologist of the national department of horticulture, was introduced, but spoke but briefly. He had not come to make a speech, he said, and after listening to such a "Rich" address he felt still less inclined to say much. He spoke of difficulties of the department in determining the names of fruits, of apples especially—of the various markings, shapes, colors, and variations of kinds under varying conditions. All these have to be studied and recorded in order to determine the variety, and the same work has to be done for the peach, the plum, orange, and every other kind of fruit. There is no end to these peculiarities, and yet we are supposed to know all of them—but we don't. One peculiarity of the division of pomology, the youngest division of the department, is that so much of its principles and details are not fully known and understood. But we all delight to study it, and the advancement made is highly promising. He said the department is always ready to help the fruit-growers, and told how to send sample fruits for inspection and name,

either the name of the fruit itself or of its diseases. Write to the department, and franked boxes will be supplied. Then send more than one of the fruits (for fruits vary upon the same tree) ; send also some of the leaves, twigs, and a description of the tree, for all these are necessary to the full determination of the variety. Mr. HEIGES said he would remain through the meeting and would be glad to help in any way possible.

In answer to a question, he replied: The Japan plums are hardy trees, and as such have a certain value, but I am doubtful if they will succeed in this region. The flora of Japan is very much like that of the Pacific slope, and the Japan plums flourish there, but are not likely to do as well on the Atlantic slope, or in the Mississippi valley or elsewhere. These plums by natural habit bloom very early—so early as to be quite sure of injury from frost. But I believe they will become the parents, by cross-fertilization, of a valuable race of plums.

The evening session, in the opera house, was the time of gathering of one of the largest audiences of the meeting, the place being filled to its complete capacity. The ladies' band again laid the people under obligation for its excellent music.

PAPERS AND DISCUSSIONS.

STATUS OF THE FRUIT CROPS OF 1894.

BY SECRETARY REID.

When the time of blossoming came to the orchards, vineyards, and small-fruit fields of Michigan, this season of 1894, the promise they made of fruitage had seldom if ever been exceeded. With no kind of fruit was this more the case than with the apple; and the people, who had for two years mourned the failure of the king of fruits, were cheered with hope of his abundant reappearance. The present and the approaching harvest time will leave those hopes but partially realized. The returns from half a hundred letters of inquiry sent to growers in the counties of the lower half of this peninsula show every grade of condition, from total failure to 70 per cent. of a full crop of apples. In a general way it may be said that there is a very light crop or none at all in the central, eastern, and southeastern parts of the state. Nothing like a good crop was reported from further east than Kent county, save that in Ingham the crop was set at 40 per cent. In the northern part of the western fruit belt the crop is

reported to be from 30 per cent. to a nearly full one. Further south in the belt, on down to Berrien county, the crop is in a number of places reported nearly a full one where unharmed by the canker-worm. The reports from Washtenaw, Barry, Clinton, Eaton, Kalamazoo, Calhoun, and Lenawee are of almost total failure save in isolated cases, the summer fruit showing a little better. None of these counties report enough apples for home consumption, and, save pears, there will be not much fruit of any kind for export. It seems plain that buyers of winter apples will have to look for them in the western portion of the state, from the southern line up to the Traverse region, but need scarcely go further than fifty miles eastward from lake Michigan.

Within this region there has been a very fine crop of Oldenberg, while Red Astrachan has quite generally failed. Reports of full bearing are made of Baldwin, Spy, Ben Davis, Rhode Island Greening, Johnathan, Hubbardston, and in some cases small young trees of Wagener.

Many writers speak of the old orchards as unfruitful, but one reporter, the owner of 4,000 bearing trees, Mr. S. SMITH of Watervliet, says his plantings of 30 to 40 years ago are bearing best. But it is safe to say that none of Mr. SMITH's trees are of the sort seen in the old orchards of the average farm. The causes of the unfruitfulness are generally conceded to be the "blight" or scab of the two preceding years, cold weather at the blossoming season and immediately afterward, and the prevailing drouth of the past two months. There is a general averment that spraying with Bordeaux mixture was highly efficacious wherever persisted in, subduing scab upon both fruit and foliage. But while many who used this spray met with partial failure from heavy rains, the success of many others must certainly cause greatly increased use of Bordeaux mixture hereafter. Indeed, so well settled is belief in its efficacy that one correspondent, Mr. W. F. BIRD of Ann Arbor, paraphrases Poor Richard's rhyme about thrift at the plow thus:

"Whoever hopes success to crown
Must either work the pump or drown."

Possibly some in California or elsewhere, where the annual production of every sort of fruit is carefully noted and compiled, will wonder what is the meaning of the phrase, "thirty to seventy per cent. of a full crop." But no one in Michigan can tell him "within forty rows of apple trees." The agricultural and horticultural statistics of Michigan are ludicrous in both their meagreness and their inaccuracy. These statistics are gathered by supervisors when taking the annual assessment. At first they exercised some care, but latterly have become quite neglectful of the duty, until the annual compilation of their reports, by the secretary of state, has become almost valueless. So we will go back to earlier and better years for some approximate figures. In 1883 there was a good crop of apples in Michigan, and it was reported to have been 1,364,202 barrels. If we accept this as reasonably correct, and assume that, as my returns show, one third of the acreage of that year is this year producing forty per cent. of a crop, we have 176,420 barrels as the crop of 1894 available for sale at home and abroad. But I regret to say no one can tell anything definite about the matter. My opinion is that our merchantable crop this year will be more than double 176,000 barrels, but it is all guesswork.

We are able much better to approximate the yield of peaches. By statistics of shipment by rail and water from Allegan county, in 1893, it was

clear that not less than 4,000,000 fifth bushel baskets of peaches were shipped from that county. I believe 2,000,000 baskets will fully represent the product of peaches for the rest of the state, making a total of six million baskets in all. The crop of 1894 will be from one half to two thirds of this amount, but probably will not equal the latter proportion.

The season saw a quite unusual appearance of the canker-worm in the apple orchards, a greater one than lies within my recollection. It was prevalent throughout the state in some degree. The most serious ravages were reported from Clinton county, where, within an area eight miles square, or thereabouts, scarcely an orchard escaped. This worm and the scab fungus are the chief sources of injury to the apple trees and their fruit this year. The codlin moth has yielded to arsenical spray, but there is comparatively little harm from this source, even where spraying was not practiced. Probably the two preceding unfruitful years had greatly diminished the numbers of this pest. It is disheartening to read the reports of the prevalence of scab throughout the central and eastern parts of the state; and still more so to learn that so little spraying has been done, despite the manifold and earnest efforts to instruct farmers in this necessary and very simple means of preserving their orchards. There seems to be a general opinion in those sections that apples can be no longer grown in Michigan. In the "fruit belt," the people know better, and the interest and abiding faith in the security and profitableness of horticulture is evidenced in the extensive and constant planting of fruits of all kinds.

Yellows of the peach tree has developed very strongly everywhere this season, unless it be in the extreme north of the fruit belt, where, if it has yet appeared, the reporters are careful not to mention it. But in Berrien, VanBuren, Washtenaw, Lenawee, and Allegan counties this insidious disease is making great inroads upon the orchards, yet there is no discouragement among peachgrowers in consequence.

The small fruits promised richly, and the strawberries very nearly fulfilled the promise, as did currants and gooseberries; but the others, the blackberries especially, were cut very short by dry, warm weather.

Grapes were severely harmed by the frost of May 28. While at Lawton some vineyards wholly escaped (those on the highest grounds), in many others the fruit was wholly cut off, so that altogether only about thirty per cent. of a crop will be realized. On the whole, not far from sixty per cent. of a full crop will be harvested. The fruit is likely to be of very high quality, for no disease of either fruit or vine is reported, and ravages by the usual insect pests were slight.

Pears and plums are quoted at from seventy-five per cent. to a full crop and in excellent condition. Many correspondents speak of the exceptionally fine condition of the pears in their freedom from scab and worms, but blight of the foliage is spoken of in several cases.

Damage by hail is reported from a number of points, being severest at Ann Arbor and in a narrow strip through the peach orchards of Ganges.

But, despite all these untoward conditions, there is great hopefulness and determination among horticulturists in all regions where the growing of fruit has become an agricultural specialty. As one reporter expresses it, "The fruitgrowers seem to be the only ones likely to escape the poorhouse this winter." In conclusion of report of a very disastrous season at Ann Arbor, Mr. Bird says: "From the above report the reader may infer that horticulture about Ann Arbor is doomed. As to its prac-

tice by many, such is unfortunately the case; but to the intelligent, persistent worker there is still hope." In the Grand river valley, from Ionia to the lake, the horticultural interest was never so flourishing, and the same is true of Allegan, Berrien, Van Buren, Oceana, Mason, Grand Traverse, and the other fruit-belt counties. If horticulture shall decline in the rest of the state, but increase here where it receives more satisfactory attention, we shall have a thorough test of our president's decisively stated idea that prevalence of yellows and other such menacing and destructive agencies is a good thing for the fruitgrower. At any rate, if horticulture has elsewhere declined seriously, it is no worse off than are the other branches of agriculture, while here, where Pomona's rule is supreme, there are few or none at all dissatisfied with their prospects.

Several gentlemen were called upon for supplementary reports, but only a little new matter was obtained. It appeared that there had been more rain in the Oceana region than further south, yet there had been injury there to the early varieties of peach. Oceana and Mason will have the largest crop of peaches in their history, and much more fruit of all kinds than ever before. Japan plums (Burbank and Abundance) prove disappointing, suffering from late frosts because of their habit of extremely early blossoming; but their fruits are good when obtained.

In Kent county both the apples and peaches are better than on the lake shore, due, probably, to the absence of excess of cold wind and rain and to the higher grounds. Drouth is making the apples under size and to some extent they are dropping.

In Allegan county there are very few peaches upon the immediate lake shore, but further back, two miles or so, the crop is full in many cases. Small fruits paid very well, and are being more generally set. Currants sold for $1.60 to $2.25 per case, and gooseberries were profitable also. Peaches were never finer in quality. The harm near the lake was done by cold winds and rain and fogs, at time of fertilization, rather than by frost. Peach trees on sandy soils recover quicker than others from curl-leaf. The lower lands, where not too wet, have latterly seemed to be the better for peaches.

In Berrien county all small fruits promised well, but suffered from drouth, yet paid as well as if the crop had been full. Fruitgrowers are very much better off than other farmers.

IRRIGATION FOR THE ORCHARD AND GARDEN.

BY PROF. L. R. TAFT, MICHIGAN AGRICULTURAL COLLEGE.

Protracted drouths, the soil baked and cracked, blasting winds, crops dried up, and farmers discouraged are among the reports that come from all parts of the country. While the meadows, oats, and wheat escaped severe injury, the potato and corn crops will be much reduced in yield. All this is due to the fact that the rainfall has been deficient in nearly all parts of the country, and the drouth has been so protracted, some sections not having been favored with even a passing shower for eight or ten weeks, that many farmers have cut up their corn in order to save the fodder, even before the tassels appeared. With these reports of widespread injury to farm crops, the results must have been even more disastrous in the vegetable gardens and orchards. From the fact that the products of the horticulturist are very largely composed of water, and that they are grown on a more intensive scale than those of the farmer, it can be readily seen that this must have been the case. Another point that should not be lost sight of is the money value of the two classes of crops, as, while the average selling price of the more common farm crops per acre will vary from perhaps ten to as much as fifty dollars, taking one season and one locality with another, the horticulturist may get from one hundred to five hundred or even one thousand dollars for the product of a single acre of land. In seasons of severe drouth, like that through which we have just passed, it will seldom happen that the ordinary crops of the farm will be reduced more than one half, from its effects, and, large though the loss may be in the aggregate, upon a single acre it will be comparatively small, so that unless some simple and inexpensive method can be employed for furnishing an artificial supply of water to supplement the rainfall, the increased returns will not warrant the outlay. On the other hand, the horticulturist, with his more valuable crops, can not afford to leave a single stone unturned that will in any way aid him in saving his crop. In seasons like the past, unless in exceptionally favorable locations, many of the less hardy plants are so weakened that the crop is practically ruined.

The fruitgrower suffers a double loss from seasons of drouth, as his crop of the current year not only is lessened, but the trees are often unable to make a normal growth, much less to form fruit buds, from which the crop of the following year will develop. Thus one year's drouth may cause the loss of two year's crops.

The experience of the past few years has convinced many gardeners and fruitgrowers that they can not afford to be without the means of carrying their crops through dry seasons by means of irrigation.

HISTORY OF IRRIGATION.

Although it has been used but comparatively little in the United States except in the arid regions of the west, it was employed thousands of years ago in Egypt and Arabia, and, although the methods used were very crude, enabled those countries not only to maintain a dense population but

to export grain in large quantities, and that, too, from land which today, from want of water, the reservoirs and irrigating ditches having been destroyed, is covered with the drifting sands of the desert. Today the most productive sections of India and the Piedmont and Lombardy regions of Europe, which are famed for their crops, owe their reputation to the fact that they are provided with well arranged systems of irrigation. In our own country, irrigation has been used to a limited extent for more than one hundred years in many of the eastern states, where the small streams are carried along the summit of ridges and the water is allowed to trickle down the hillsides. The land thus watered is generally used as a permanent meadow or pasture, and the growth of the grass is generally more than doubled. In the west, the Mormous in Utah were among the first to utilize the water of the streams for purposes of irrigation. They dug ditches along the base of the foot hills, and catching the waste water prevented it from entering the streams. It was then carried in trenches and used to irrigate the cultivated lands. Throughout Colorado and California, and to some extent in other western states, irrigation is regarded as almost necessary for the growing of paying crops, although in some seasons the rainfall is sufficient, without it, to give fair returns. We find here many elaborate systems used for supplying water to the orchards and wheatfields. Some of them have cost hundreds of thousand of dollars and carry the water for fifty to one hundred miles, with the capacity to irrigate fifty thousand to one hundred thousand or more acres. In most cases the water is taken from the rivers, a dam being used to raise the water to the level of the bank. At other times a wing dam is used to project obliquely into the stream and turn a portion of the water into the irrigating ditch. To keep up the supply in the dry season, when the water is most wanted, immense storage reservoirs, some of them holding enough water for 50,000 acres, are often constructed back in the mountains, from which the water is taken as needed.

The main ditches, which are often twenty-five feet wide and six or eight feet deep (a few measure from fifty to seventy feet wide) are carried at a slope of two to three feet to the mile, and from these the distributing ditches are taken off. The angle which they make with the main ditch depends upon the slope of the land, as, if they descend at a greater rate than eight feet to the mile, the banks will be badly washed. If a quick descent is imperative the water is carried in wooden flumes or in iron pipes. The bottoms of the smaller ditches are often paved or lined with cement. wherever the fall is considerable or so open as to permit of rapid percolation. When ditches of considerable length are necessary it is estimated that as much as three fourths of the water is lost from evaporation and percolation before it reaches the distributing ditches.

The method used for applying the water to the land depends upon the character of the crop as well as on the nature of the land and the amount of water.

HOW SHALL WE IRRIGATE?

In very few sections of the eastern states is it probable that irrigation will become sufficiently general to admit of any concerted action, and for the most part small private plants will be the rule. While we expect increased attention to the distribution of the water of streams over the surface of water meadows, the interest that is now being shown in the subject of irrigation by horticulturists in all parts of the country warrants

the prediction that in the future it will be made use of in orchards and market and kitchen gardens. Not only can the streams themselves be thus used, but the water from springs and the storm water from the hill-sides will be caught in reservoirs and stored for use in time of need. In many places, too, when one lives near large towns and cities with an abundant supply, arrangements can often be made with the local waterworks for what is needed. If these resources fail, there are few sections where sufficient water can not be readily obtained from a good driven or bored well to water at least five acres. A good pump worked by a twelve-foot wind-mill, or by hot air or steam, will bring the water to the surface and elevate it to the storage reservoir. Especially if the wind is depended upon as the power, this should be of ample size, as this fickle force may fail at the very time it is most needed, and at best it can hardly be depended upon for more than eight hours per day.

A large storage reservoir can often be cheaply constructed by damming up a ravine or by excavating for it at some point where it will have an impervious hardpan, but when a well is drawn upon for the supply, a large wooden tank will be found to answer the purpose. For irrigating five acres it should have a capacity of not less than 800 barrels. This will hold water enough to give one acre a covering to the depth of one inch. With a well and pump able to fill the tank in twenty-four hours, an acre can be irrigated each day, and as the land will seldom need water oftener than once in a week or ten days, the five acres can be handled without trouble, and in most seasons there will be a considerable surplus.

Although the common ditch may be used to advantage where the water is plentiful, some impervious pipe will generally be found preferable to convey the water to the land. When not larger than two inches, a wrought iron pipe will generally be cheapest in the end, but for larger sizes a galvanized iron pipe lined with cement will answer every purpose, and if properly made and laid will stand any ordinary pressure. In California laminated iron pipes are largely used. They are made of two thicknesses of sheet iron with a space between them of an eighth of an inch filled with asphalt, while the inner and outer surfaces are coated with the same material. When there is but little pressure, vitrified sewer or cement pipes can be used and will answer every purpose. In the west a machine is used which makes a cement pipe in the bottom of the trench, but it is not regarded very favorably.

DISTRIBUTING THE WATER.

The method that will be best adapted for applying the water to the soil is yet to be determined, and is, perhaps, the most important question of all.

SPRINKLING.

In the past there have been various attempts made to irrigate land by sprinkling the water upon it from perforated tin pipes supported some five or six feet above the ground, while others have called the street sprinkler into use. But little or no success has been obtained from either method. A third method is by means of revolving lawn sprinklers, while others have used lines of hose with a nozzle at the end arranged to throw a fan-shape spray. For watering in either of these ways hydrants are located at the center of tracts rather smaller than an acre to which iron pipes of

about one and one half inches in diameter run. With a strong head of water and a large hose it is claimed that a man can water five acres per day, but it certainly would reach no great depth. Moreover, this method of watering can not be unreservedly commended, as even if water enough is applied to soak to the depth of ten inches it is more than likely than one half if not two thirds of it will be lost by evaporation. It will tend to compact the surface soil, especially if it is inclined to be heavy, and if it can not be cultivated it may do as much harm as good. At the very best, then, this method of watering the land is not adapted to clay soils, and it does not seem equal to some of the other methods, except, perhaps, upon small areas, where the town or city waterworks can be drawn upon for the supply.

SURFACE IRRIGATION FROM FURROWS.

If water is to be applied in any way upon the surface, running it over the land in furrows and allowing it to soak into the surrounding soil will be found the best system. If this method is used, a little attention is often required to prepare the land for irrigation by filling up depressions and scraping off elevations, but as this can all be done with a team and scraper the expense will not be heavy. Care should be taken that the furrows have only a gentle slope, and it will be best if it is only enough to give a gentle current to the water, as the furrows can then be flooded and the water will soak in evenly along the rows. If no more than one foot in one hundred, they can run down the slope, but if much in excess they should run diagonally or even be carried along the slope with a slight fall. In land that is quite steep the hills can be circled and the water run over the lower edge, any surplus being caught by the furrow below. In some cases slight terraces are made with a plow and the furrows for the water are run on these. On level land a shovel-plow can be used to advantage, but on the side hill a common mould-board plow, used so as to turn the furrow up the hill, will be preferable. When an ordinary cultivator is used in working the crop, if the soil is slightly turned from the rows, a trench sufficiently deep for the water will be made. In small gardens the trench can be quickly made with a hoe, and one should be made use of to even up any inequality of level and to dam the water back when necessary. If close together, furrows between alternate rows will be sufficient, but when further apart, for such crops as the melon and cucumber, a furrow close beside each row will be preferable. The method used in the west for crops in close drills will also be found useful here. By back-furrowing the land twice, a proper slope can be given the beds (15 to 30 feet) from side to side, but special plans will be required in laying out the beds in order that an even slope longitudinally may be secured. When used for small fruits that are planted at four feet or less between the rows, if there is a furrow in every other space it will suffice, but if the distance is much in excess of this, there should be one in each space. In orchards, one furrow will, as a rule, answer for two rows of trees, if a branch furrow is given off to each of them. The water can be applied to the best advantage if the soil under the trees is so arranged that the water can be spread out in a thin sheet as large as the circle of the branches. In the case of bearing trees, however, it will be best if the water is not allowed to come within from two to four feet of the trunks.

No general rule as to the amount of water that will be required can be given that will apply to all crops and all seasons, and the same can be said as to the length of time that should elapse between the different irrigations. Besides the above conditions, there are several others that should be considered, such as the temperature and dryness of the air and the amount and distribution of the rainfall. As a rule, we would recommend that not less than one inch of water, amounting to eight hundred barrels per acre, be used, except, perhaps, for young trees and other crops that do not fill the entire ground with their roots, at one watering. The amount supplied to the crop can be varied by the number of applications. In seasons like the present, a thorough watering once a week will be none too much for many crops, but for others, from one to three waterings will suffice. For the small fruit crops the last watering should be given just before they begin to color, as water applied after that time will make them too soft for shipment.

Even with this method of irrigation a considerable portion of the surface soil will be saturated, and if it is clay it will bake so that a large amount of water will be lost from evaporation. If water is scarce, and especially if the irrigation is less frequent than once a week, the surface should be given a thorough cultivation so soon after each watering as the land is fit to work. In case the ground beneath the trees is flooded as recommended, a mulch will be of value to hold the water.

When this method of irrigation is practiced the water can be carried to the furrows in various ways. If pipes are used and the furrows are twenty or more feet apart, the pipe line may be carried along the ends of the furrows and the water supplied at pleasure through small hydrants or faucets opposite each of them. A small wooden flume may also be used in the same way. When closer together the water from the feed pipe may be turned into a distributing furrow that is carried along the upper side of the field from which the small furrows receive their supply. A better way is to locate hydrants supplied by one-and-one-half to two-inch pipes from which the water can be turned into the furrows through large fire hose, which can generally be bought quite cheaply second hand. If a large area is to be watered, three-inch pipes should be run to some central point from which it can be distributed in smaller ones. In some cases the small pipes are run upon or just beneath the surface of the soil and are of course taken up in the fall.

If the furrows are properly laid out and a good head of water is at hand it can be run along a trench for three or four hundred feet, and only a minute or so will be required to fill it; if the land is nearly level it will generally be best to be able to apply the water at intervals of not over two hundred feet.

SUB-IRRIGATION.

Although somewhat more expensive at the start, this system will work with little or no care, and on many accounts is preferable to any of the others under proper conditions. It consists of lines of drain tile laid from one to two feet below the surface and at intervals of from ten to thirty feet. The lines of tile should have even less slope than the furrows, if an even distribution is desired, and if level it will be all the better. If there is much head to the water the joints of the tile should be laid as close as possible, and at any rate all large cracks should be avoided. The depth and the intervals between the tiles will depend to some extent upon the

amount of water at hand and the character of the soil, as the deeper and further apart they are the more water they will require. In an open sandy soil some of the water will be lost in the subsoil, but the system is particularly adapted to land with a stiff subsoil which will retain it until it is all absorbed. While good results can be obtained upon a sandy soil, especially if it is rich in organic matter, the system of applying the water to the under soil is decidedly preferable upon a clay soil to any system of surface irrigation, as there will be no trouble from the baking of the surface, and if an occasional stirring of the soil is given the surface will be kept light and open and will form an almost perfect mulch, which will go far to prevent loss from evaporation. On scraping this away, the under soil will be found full of moisture, while in unirrigated land it will be as dry as dust. As showing the conserving effect of the earth mulch, it may be stated that footprints in the light surface soil show up almost black, as compared with the light color of the loose, dry soil, in the morning, before the water that has been brought up from below is evaporated. This is of course a common occurrence in any soil, but is particularly noticeable upon irrigated soils in dry weather.

In sandy soil it will be best if the tiles are not more than twelve or or fifteen inches below the surface and unless there is an abundance of water, under a good head, the nearer the tiles are together, down to a distance of ten feet, the better, and a saving of water can often be made if they are even nearer. When as near the surface as this, unless the soil is well drained, care should be taken that the lower ends of the tile are open, that the water may run out in winter and not burst the tiles by freezing.

Three-inch tiles will answer for the laterals (a smaller size may be used) and a number of them may be connected by a larger size, into which the water can be turned through a line of hose or directly from the supply pipe. When this method is employed in the orchards of California, cement or sheet iron pipes are used with a small hole near each tree through which the water is supplied to the roots. When a moderate pressure can be obtained a circle sixteen feet in diameter is watered through each opening. For use in young orchards, where the trees do not occupy all of the ground, a saving of water could be made if, instead of leaving all of the joints between the tiles open, those between the trees are closed with cement.

In soil that is inclined to be wet in spring or that is likely to be saturated by heavy rains during the summer, the pipes used for sub-irrigation can be so laid as to serve for the removal of the surplus water. If placed at a depth of from twenty to twenty-four inches it will only be necessary to connect the lower ends of the lines of tile to a main drain, and have it so arranged that the water can be held in them or let out, as is desired.

It may be well to note here that on stiff soils the best results can not be obtained from irrigation unless some efficient means of drainage is combined with it, and when the combined bed and furrow method of watering is used for garden crops it is often desirable to have a line of tile beneath each of the dead furrows between the beds to take off any surplus water. The system of sub-irrigation described above will serve for both purposes with little extra expense, and if at any time the water in the soil is present in excessive quantities, either from rainfall or careless watering, it can be readily removed.

Another advantage of sub-irrigation is that considerably less water is required than with any other system of watering. With a stiff subsoil

many claim that better results can be obtained with one fourth the water required by any other method, and even on almost clear sand the amount is less rather than more.

Sometimes one does not have water at hand that can be applied in any of the above ways, and yet he has some valuable crop that will be greatly reduced in value in seasons like the past if water is not supplied in some way. Water can often be hauled in tanks a distance of a mile or so and applied in furrows between the rows of drilled crops or in basins around fruit trees, from which it will soak into the ground and perhaps return twice the expense of the outlay. With fruit crops the gain is especially noticeable, as not only is the crop of the present year benefited, but it enables the trees to form fruit buds for the next year's crop. In the older parts of the country the apple has its odd year from the fact that the soil has become exhausted and the trees are not able both to perfect the crop and form fruit buds for another year, but when irrigated they give bounteous crops each year, and the trees being at no time pinched for lack of food make a much better growth and come earlier into bearing.

DOES IRRIGATION PAY?

Well, it depends. In what we have said above we have endeavored to point out some of the best methods and the reasons for and against each, but the conditions are so variable that it is difficult to give any general rule. Taking one year with another, for garden crops we can say that as much can be raised upon one acre of irrigated soil as upon two without irrigation, and where the price of land is high and the crop is such that the expense of cultivation is large, one can go to a considerable expense for irrigation, with profit. From fruits, on many soils, an even greater gain can be obtained. For such crops, if running water is available, there can be no question as to the profit of irrigation.

An engine, pump, and piping sufficient for irrigating ten acres should not cost more than eight hundred to one thousand dollars, while a windmill and tank with piping for five acres will cost about half as much, so that there is little difference in the first outlay, but the latter is of course cheaper to run, although less reliable. If much irrigating is to be done, it will be well to have both powers, so that steam or hot air can be used if the wind fails. The expense of preparing the land for surface irrigation will often be little, if anything, while if sub-irrigation is used it will run from twenty-five to fifty dollars or more per acre. The cost of applying the water will be one dollar per acre if obtained by means of a windmill, or two and one-half to three dollars if a steam pump is used, for each irrigation, and will seldom be more than four or five dollars in the one case to ten in the other, per acre, for the entire season. Supposing that the pump and other machinery were only used for this purpose, which is hardly probable, and allowing for interest and depreciation, fifteen to twenty dollars per acre per year will be a high estimate. It should also be noted that if the water supply is sufficient and an engine is used it can be made to do more than twice as much as is called for above, if irrigation is carried on at night, and the cost of maintenance will be reduced one half per acre.

We have then at the very outside to consider as to the profit when irrigation costs twenty-five dollars per acre (if the pump and power are used for other purposes this can be reduced one half), and while few farm

crops will stand this outlay, it is certainly a good investment upon many grown by the horticulturist, as will be seen from the fact that a crop worth one hundred dollars if irrigated, is only half as valuable without it, which gives a net profit of one hundred per cent.

Many cases can be cited where crops that would not have been worth one hundred dollars per acre, if they returned the cost of harvesting and marketing, without water, were worth from three to four hundred dollars when given two or three irrigations.

Where failures have been met with, it has been generally the case that too much has been attempted for the amount of water at hand. Good results can not be expected without a supply sufficient to wet down to the roots at least once in ten days in a dry season, and if this is done there can be no question as to the results.

Mr. MONROE called out Mr. M. B. WILLIAMS of Kalamazoo, who had been making some experiments in the way of irrigation of his fruit farm near Douglas.

Mr. WILLIAMS: We decided this season to see what could be done in the way of watering a portion of our ground, but did not get our plans into operation soon enough to secure very decided results. We only began three weeks ago, too late to save corn, but it helped some with the strawberries. We started with the idea of using a wind-mill to pump the water from a brook to the requisite hight, the top of a ridge, whence the flow of water would be toward the river, but we found that the mill had not power enough to elevate water for any but small tracts. So we got a ten-horse-power engine and have placed a four-inch pipe along the ridge. We have intended to tap this with other pipes, but have found that the water will run far enough in open trenches. The supply from the stream was found to be inadequate also, and next season we shall pump from the river. From a four-inch pipe the water will run in a quite respectable brook. Whether one dollar expended in irrigation can be made to return more than ninety cents of increased yield is something we are not yet able to decide. Prof. TAFT'S figures correspond closely with our own, as to cost of plant and operative expenses. One difficulty, that of carrying water over undulations, we have not yet solved. The stream can be banked up and carried over slight depressions, or may be led around the little elevations. If I were to select land for irrigation, I would choose that which is level, for the head of water will carry it some distance; at least, a very slight descent is sufficient. It would be difficult to make use of storage tanks but reservoirs may be used if not too expensive. Generally, water enough can be obtained from tubular wells, for the supply is practically without limit, but it would probably be too expensive. In our present experiment we have to elevate about forty feet, and can supply enough water for twenty acres.

It was asked if any injury comes from use of cold spring water in supplying plants. Prof. TAFT said he used such water upon cucumbers and squashes, which are as tender plants as any, but without damage to them on account of the temperature of the water.

Mr. WILLIAMS: After running the water two hours, and covering two acres of strawberries, between the rows, we found that the water had soaked outward only two or three inches; but next morning we found that it had gone down, and returning had wet the entire ground.

Prof. TAFT: That is the natural action of the water. It rises by capillary attraction in the soil. I have had the same experience. Water has been known to meet in this way from ditches which were two rods apart.

Mr. J. N. STEARNS of South Haven, who was to supplement the treatment of the irrigation question, was presented.

He said that the past three years have given us seasons of prolonged and severe drouth, nearly as bad as the dry seasons of California; and, if these are to continue, or occasionally recur, we shall have to depend upon artificial supplies of water. He is thoroughly satisfied that what watering of orchard trees he has done has been profitable. He can in a single day, with two men, give twenty-five to thirty gallons of water per tree to 80 to 100 trees. The earth is first pulled away from the tree, hoes being used for this purpose, to the depth of several inches, but not so deeply as to injure the roots. The water is then poured in and allowed to settle out of sight before the earth is replaced. Moisture may be found around the trees for two weeks after such a watering. The removal and replacement of the upper earth prevents crusting and acts as a mulch. This should be done each two weeks, and he should have begun earlier this season. He has 500 bushels of plums this season, which he would not have had but for the water given the trees last year, so beneficial is the irrigation to the trees in ripening their crops and establishing fruit buds for the next season's crop. He has had three successive crops of Lombard plums, and this would have been quite out of the question but for the irrigation. Effect of the water is very perceptible in the pear orchard also. He has only watered the bearing trees, and on these the foliage is fresh and green, while on those having little fruit, and no water, the leaves are dropping. He thinks the interest upon cost of windmill and tanks sufficient to be of much service would do the watering upon one thousand trees or more. He places the water four feet away from the body of the tree but it will soak throughout a circle eight to ten feet in diameter. He uses casks and draws water from the river, but thinks a tank and hose would be better. His soil is mostly clay and he keeps up cultivation during the time of watering.

Mr. M. B. Williams: I have been surprised to see how much Mr. Stearns has done with a little water. His practice of pulling the soil back over the water provides a mulch and is superior by far to surface irrigation in his soil. I think the amount of water and the manner of its application, however, would not be so good for my lighter soil.

Mr. Morrill advocated planting further apart all sorts of fruit trees and vines, partly in order that they shall not so quickly absorb all the water from the soil.

To this Mr. Stearns agreed, saying his observation had convinced him that more room should be given to fruits of all sorts. He instanced the much greater yield of his outer row of gooseberries, as an illustration of the better results to be obtained by such wider planting.

Mr. C. B. Welch: Will subsoiling answer as a substitute for irrigation?

Mr. Stearns: Nearly all of my ground is subsoiled, which I think nearly equal to underdraining, but I do not regard it as a substitute for irrigation.

Question: What is the proper distance for planting peaches and pears?

Mr. Morrill: Not less than 20x20 feet, and better 24x24 feet for peaches and standard pears. Like Mr. Stearns, I find my best product of gooseberries at the outer rows of the field.

Mr. Stearns: I have made two mistakes in my planting of fruit orchards and fields: I have planted too closely and taken too many crops from a plantation before replanting.

AN ADDRESS.

BY HON. HENRY F. THOMAS OF ALLEGAN.

President MORRILL introduced the Hon. H. F. Thomas, member of congress from the fourth district of Michigan, who made the following address, which was very heartily applauded at its close:

GENTLEMEN OF THE SOCIETY:—I am happy to be with you for two special reasons. In the first place, you represent an industry which in its material benefits to society, as well as in its ennobling influences upon character, places it at once in the first rank of human occupations. Chemical analyses and medical experience demonstrate that fruits and grains are the normal food of man. It is worthy of note that the Lord God planted in the center of Eden not a slaughter-house but an orchard. It was a tradition among the Greeks that in the golden age mankind lived on acorns while the gods lived on walnuts. Our historical scripture informs us that in the beginning man was given the freedom of the garden, but the apples were reserved for the gods.

In the next place, you represent the leading industry of the district which I have the honor to represent. The successful culture of fruit depends upon a peculiarity of soil, atmosphere, and temperature which prevails in a wonderful manner in the southwestern counties of Michigan. Each of the four seasons furnishes those characteristic conditions without which our most delicious fruits would never reach perfection. The same apple grown in Van Buren county, commanding the highest price in the Chicago market for its flavor and richness, planted on the Pacific coast in the orange belt is woody and tasteless. The prevailing western winds, tempered by the waters of lake Michigan, over which they sweep, shield us from the late and early frost. And here, where but a generation ago dense forests prevailed, filled with wild beasts and Indians, today the entire country from the lake to the headwaters of the St. Joseph, and from the Grand river to the Indiana line, displays an unbroken series of gardens, orchards, and grain fields that would have excited the envy of the Pharaohs in the palmiest days of Egypt and the Nile.

Pomology as a science, we are told, dates from the reign of Henry VIII. Since then a voluminous literature has sprung up on both sides of the Atlantic. In order to understand its position among the sciences, let me say that it deals with but a segment of the vast circle of vegetable life. Botany is the generic term embracing the entire circle, dealing with plants only as to their normal condition, while horticulture deals with such species and varieties as are produced by cultivation and exemplify nature as elaborated and modified by the art of man. Pomology, then, is only a department of horticulture, and has for its specific object the culture of fruit as distinguished from vegetable or grain culture.

But, after we have thus limited and located the subject, to advance which your society was formed, we have still before us a vast field of inquiry which the short years of a lifetime will not suffice to master. DOWNING,

in his elaborate work on fruit culture, devotes nearly three hundred pages to the enumeration of the species and varieties of the apple alone; while another writer selects from this exhaustless catalogue about eighty varieties which he thinks may be grown to perfection in the state of Michigan. In fact, the subject has already assumed such proportions that WARDER has published a large volume devoted to apple culture alone. And so, in all large libraries, separate works may be found on the culture of the orange, lemon, grape, peach, apricot, and other fruits. Annual conventions are now held in most of the states, devoted to the subject of fruit culture, and the fruit exhibits of our county, state, and world fairs has but few rivals in magnificence and display.

Of the commercial advantages of fruit culture, of the art and science of cultivation, I have not the time to speak, but will take this opportunity to refer briefly to certain ethical and intellectual considerations involved in fruit culture. We have said that it was one of the most ennobling of occupations. The conditions are most favorable to health. The character of the soil and climate, which gives color, flavor, and richness to fruit, gives strength to the arm that cultivates it, light to the eye, color to the cheek, and health to the body. Few fruits, indeed, and none of the highest order, come to perfection in malarial districts. The apple, the peach, the cherry, and the strawberry, most delicious of fruits, are products of the temperate zone, within which cultivation has achieved its greatest conquests, man his highest development.

But physical health is not the only boon of fruit culture. Its opportunities for mental discipline and study are of the most interesting character. Here the biologist finds himself in the midst of phenomena which embody the origin of all life; for animal life is nothing but an elaboration of vegetable life. Here the geologist may learn the properties of strata and of soil in the flower and chemical qualities of fruits. The reason why the wine of the valley of the Druro, the prunes of Turkey, the coffee of Java, and the apples of Michigan have a flavor so unique and so incomparable is to be found in the soil or beneath it. And then, in the art of budding and grafting, what unlimited scope for analysis and synthesis and mechanical ingenuity! It has been said that God made man in his own image. I suppose this means that man is endowed potentially with divine power. If man ever reflects the image of the creative First Cause, it is in the wonderful triumphs of fruit culture. The power which transformed the original crab apple into the luscious Baldwin or Northern Spy, is certainly akin to that high prerogative which created the crab.

The most valuable of northern fruits, perhaps, is the apple. It will resist the changes of climate, endure neglect more patiently, and respond to kind treatment more readily than any other fruit. Its juices form a delicious and wholesome beverage; as a table decorative and dessert it surpasses its tropical rivals, while in the dried state or in cellar storage it supplies our wants for the entire year. Excellent bread has been made by the French by a mixture of two thirds flour with one third apple, without water. For cattle and hogs, sweet apples have long been held in high demand. Think of pork, ham, and bacon fattened on sweet apples! If anything could prevail against the conscience of a Jew, I think it would be fruit-fattened ham and eggs.

Again, fruit culture has an ethical bearing as to food. The dispositions of men are affected by diet. This is seen in the study of the different races. The Indian, living principally upon meat, is bloodthirsty and

cruel. The Brahmin, who eats no meat, is sympathetic, kind, and spiritual. Mankind, in its evolution toward the highest, will use more fruit and grain and less liquor, tobacco, and meat. It is a known fact that the habitual use of stimulants and narcotics destroys the taste for fruit. This alone is a conclusive argument against the use of stimulants and narcotics. Who does not call to mind the fruit eaten in childhood? I remember well the early days of Michigan, when apples were exceedingly rare and pumpkin sauce was plenty. How often, in the late months of February and March, I have explored the cellar for the last decayed survivor of the apple crop! and I declare to you that the finest specimen now exhibited at our fairs falls far below in flavor those fragments that my childish tongue fed upon. Alas! the fault is not in the apple—my taste has degenerated.

But, in another sense, fruit culture is ennobling. The orchardist cultivates a friendship for his trees which is reflected in his own character. He plants them with his own hands. He watches their growth from year to year, remembers their age as he does those of his children. He knows their history, remembers the date and character of the budding and grafting, the year they began to bear, their dessert and keeping qualities, their relative standing in the market, and the difference in size and flavor between the same fruits raised in New York and raised in Michigan. And he delights to recount these facts to his friends and visitors.

I am indebted to a newspaper article for the following bit of history: On an orchard ranch, two thousand five hundred feet above the sea and sixty miles from the Pacific coast, lives a retired physician, spending the remainder of his days among the flowers, plants, and trees of his own planting. Showing a stranger through his orchard one day, he stopped by a French prune tree loaded with fruit, its first bearing. "This," said he, "is a very choice variety. It was selected by my son and by him budded into a plum tree only three years ago. He was anxious to know the result, but, poor boy! he died of hereditary consumption last year, and at his request we buried him on yonder knoll, overlooking the orchard in which he took so much interest."

Thus the tree-planter breathes the fragrance of the blossoms of his trees, gathers the autumn harvest from their branches, rejoices in their growth, entwines their history with the memory of friends and home, and lives and breathes in the very atmosphere of their fragrance and beauty.

Before concluding I wish to recommend the practice of planting fruit trees along the roadside and fences. This practice has long prevailed in Germany, and to some extent in England, and in our own Atlantic states. It has the merit of utilizing space which otherwise would be wasted. Many fruit trees are decidedly ornamental, especially the cherry and hickory nut, and thus the highways would be made more attractive and the farms beautified. But there is another consideration which should appeal to every land owner, and that is the blessing that would be thus conferred upon the wayfarer and stranger and those neighbors who are too poor to own orchards, in the gratuitous supply of fruits. And again, the cruel barbed wire, whose treacherous wire-dogs often lacerate like the fangs of a serpent, could be safely shielded in a beautiful hedge of blackberries, currants, or grapes, guarding at once from danger and supplying an added dish to the poor man's table. To be sure, such trees and plants would lack the order and care of a regular orchard, but I can not doubt that the regular orchard would gain many compliments by the contrast that would

never have been suggested without it; just as finished pictures are often put in rustic frames. Moore, the Irish poet, describing an oriental scene, says:

> "Rocks are rough, but smiling there
> The acacia waves her yellow hair,
> Lonely and sweet, nor loved the less
> For flowering in a wilderness."

After all, every occupation, in some sense, should possess an aspect of disinterested kindness for those who are less fortunate than ourselves.

When the title to our lands has passed to strangers, in the shade of the trees we have planted many a foot-sore traveler may sit down to rest and bless the benefaction, although he has never heard the name of the benefactor. Let us in all things adopt the language of the universal prayer:

> "Teach me to feel another's woe,
> To hide the fault I see;
> The mercy I to others show,
> That mercy show to me."

POSSIBILITIES OF NUT CULTURE IN MICHIGAN.

BY MR. W. A. TAYLOR, U. S. DEPARTMENT OF AGRICULTURE.

Nut culture is of recent development in the United States. Like all new fields of horticultural enterprise, it requires careful investigation before being entered by the cultivator who would avoid disappointment and financial loss. What is its history? What are its limitations and its possibilities? These are the questions that I would briefly discuss, paying particular attention to the needs of the Michigan grower.

History—Its history in Michigan is chiefly noticeable by its absence. Aside from local tradition and an occasional reference in print to a small chestnut or black walnut grove, it has none. In that admirable and exhaustive sketch, " A History of Michigan Horticulture " prepared a few years ago by President Lyon, the references to the culture of edible nuts do not outnumber the fingers of one hand. With native beech, shagbark, hazel, butternut, and walnut widely distributed throughout the state and the chestnut growing in a few localities, the pioneer had little need to look elsewhere than to the neighboring woodland for his family supply. Quantities of wild beechnuts, butternuts, and walnuts were marketed in the earlier days and doubtless are now in some sections. But taking the state as a whole, and especially that portion of it lying south of Port Huron and Grand Rapids, it can safely be said that the day of self-planted nut groves is ended. If the city and village markets, as well as the farmer's table, are to be supplied from within the state rather than by purchase from other states or by importation from foreign countries, nut bearing trees must be planted.

Limitations—Will the planting of nut trees pay? There are two sides to this question, one of which can be promptly answered in the affirmative. Prof. Satterlee, writing some years ago of his own experience with a 25-year-old mixed grove of 100 trees of chestnut, walnut, and butternut in Montcalm county, stated that the same land in potatoes would have paid him much better than the trees had done in either nuts or timber. "But," he continues, "happily its value does not depend on the amount of stovewood it would make now or the amount of sawing timber it will make at some time in the distant future. It has paid a good interest on the use of the land every year since it was planted by its adding one more attraction to the old home place." This view of the question should not be overlooked. Viewed from the standpoint of the believer in more attractive and interesting farm homes it will pay. But the other and more practical side of the question to the grower who is after the dollars, is that of the pecuniary return from such planting.

In discussing this let us first consider the question of present market demand for nuts. We have no statistical information on either the present production or consumption of edible nuts in Michigan. But from certain data within our reach an approximate estimate of the latter item can be made.

The production of edible nuts (exclusive of cocoanuts) in the United States for the year 1889, according to the census of 1890, was valued as follows:

Pecan	$1,616,576 50
Almond	1,525,109 85
Persian walnut (Madeira nut, English walnut)	1,256,985 00
Total	$4,398,671 30

No statistics on other nuts than these were collected by the census.

The importations of nuts for the fiscal year 1889–'90 (almost entirely of the crop 1889), were as follows:

Almonds	$813,278 00
All other (except cocoanuts)	800,376 00
Total	$1,613,654 00

This gives us a total of $6,012,325.30 as the value of the nuts used in the United States in one year, without including the beechnut, blackwalnut, shagbark, and pinon of which large quanties are used, or the omnipresent peanut which forms an important article of commerce. It will be noticed that none of the kinds mentioned in the statistics of either the home production or importation are grown to any extent in Michigan.

By comparing the population of the country in 1890 with the value of the nuts consumed it will be found that the consumption amounted to about $9\frac{3}{5}$ cents for each person. If Michigan got her share (and in the matter of edibles I think it will be conceded that the Wolverine usually does) the 2,093,889 inhabitants of the state consumed a little more than $200,000 worth of nuts and nut products, in addition to those grown within the state. Allow one half of this amount for the inaccuracies of the census

and other uncertainties and we have left the somewhat startling fact that the nut importations of the state equal in value 200,000 bushels of wheat at present prices—the product of 10,000 acres of good land.

It is not to be presumed that all, or even the greater part of this consumption, will be supplied in the near future from within the state. Many of the imported nuts are of a tropical or semi-tropical character and are therefore not to be considersd in this connection. Of the leading nuts consumed the almond is hardly worth a trial unless possibly in the mildest sections of the fruit belt. Its early blooming habit is its chief defect.

But the hardier, late blooming varieties of Persian walnut, and the precocious, large-fruited chestnuts of both the Japanese and European types are worthy of the attention of experimenters who have land and climate suited to their requirements. The European filberts and cobnuts should also be tried, especially in localities where the native hazels thrive.

Possibilities.—As a beginning in the line of husbanding our resources, a careful search should be made for trees of the shagbark hickory, yielding nuts with thin shells, that crack so as to yield their kernels in unbroken halves. Such trees should be protected and cared for and their product kept apart from inferior nuts in harvesting. A market for these nuts can be readily found at good prices when any considerable quantity is available for purchase. They are sought by confectioners who use them in candying and cake-making, and their preparation for these uses has developed into an industry of considerable magnitude in some parts of the east. In portions of Connecticut and Pennsylvania, where native shagbark trees have been preserved and cared for on farms, they now afford considerable revenue to their owners. The shagbark is of slow growth and in the north is a very difficult tree to transplant or propagate by grafting. It is therefore not so well suited for planting as some others.

As an erect and handsome ornamental tree I am confident that the pecan will be found a success in the mild climate of the fruit belt. Trees not more than one year old, or fresh nuts secured in the fall, may be planted in the rich, moderately moist soil. Whether trees or nuts are planted, they should be from localities as far north as good stock can be secured. They should by all means come from north of Cairo, Illinois. The fruitfulness of this species in our climate, as well as the desirability of its product in the north, is a matter of doubt. It makes a magnificent tree much further north than it bears profitable crops of nuts.

Of the walnuts worth planting, the Persian is the only one that can now be recommended for its fruit. The varieties best suited to Michigan are, without doubt, those that like the college boy in the song, "Go to bed early and get up late." The worst fault of most of them is that they start growth too early in spring and fail to properly ripen their wood in the fall. This early blooming habit is a strongly marked characteristic of the so-called "English" walnut, the discovery of which has cost California growers years of time and thousands of dollars in crop failures. Such recently introduced varieties as Præparturiens, Mayette, Franquette, and Chaberte, all of French origin, have proved to be late bloomers and early and abundant bearers. They are worthy of trial by those who have rich, well-drained soil, in situations not exposed to the full sweep of cold winds. They can be propagated with some certainty from seed but better by means of grafted trees which can be had at some of the large nurseries. Trees of this species should be given plenty of room. They should not be

planted to stand closer together than thirty to forty feet, after reaching twenty years of age. They can be readily transplanted when one or two years old. There is a strong probability that some of these varieties will be found hardy enough for sheltered locations in the fruit belt. Where it is possible they should be planted in the vicinity of black walnut trees to insure fertilization of the blossoms. California growers are planting the black walnut and several other species in their Persian walnut orchards to accomplish this result.

The recently introduced Japanese walnut (*Juglans sieboldiana*), resembles the Persian walnut in appearance of nut, though the tree is more like that of the butternut. Those that I have had under observation start into growth in the spring even earlier than the Persian walnut and are therefore more likely to be injured by frost. Unless there are other types of this nut which bloom later it is of doubtful value to the Michigan grower.

Were it not for a somewhat mysterious disease to which the leaves are subject, the filbert could be recommended as likely to succeed in Michigan. And in view of the ease with which it is propagated, both by seeds and suckers, it is perhaps worthy of experiment. It will thrive on dryer and poorer ground than any other nut tree save the chestnut, though a moderately rich loam suits it best. As a shrub for the lawn where a low mass of green is desired, this can be planted. After becoming well established it should be pruned back in spring, taking care that the fruit spurs and catkins be not removed. They new growth requires some thinning out in summer to prevent a too vigorous growth of sprouts in the middle of the bush. The hazel, unlike the chestnut, thrives on limestone land. Named varieties have been but little grown in this country. The writer has received from Mr. A. S. FULLER of northern New Jersey some very good nuts grown from seed obtained by him from England. It is probable that varieties suited to our climate could be developed in a few years by growing seedlings in this way.

What seems to me to be the most promising nut tree for Michigan is the chestnut. As already noted, this is native in but few localities in the state. Beal and Wheeler's Flora record it as occurring naturally only in Monroe, Washtenaw, and Wayne counties. But the tree thrives in most of the lower four tiers of counties when planted in suitable soil. It prefers a somewhat elevated slope, with a dry, sandy or gravelly soil, containing little or no limestone. It is therefore suitable for planting on many sites not suited to other nuts. All native bearing trees should be carefully preserved. Were quality the only point to be considered, the American species would be the best one to plant. But productiveness and large size are important factors, and in these particulars the native nut is inferior to the Japanese and European types. When large fruited varieties of the native nut are discovered (and there is good reason to believe that they exist), the native nut will probably lead all others in the market plantations. But until these come to light, the planter should confine his efforts mainly to a few of the best varieties of the foreign types. Of these it may be said that the Japanese varieties are more dwarf in growth, bear earlier, and furnish the largest nuts, though they are often of very poor quality. The European type is of larger growth, bears at a comparatively early age, and furnishes nuts of fair quality. The Numbo is perhaps the best of the tested imported varieties. Paragon and

Ridgely, both seedlings grown in this country from trees of the European type, bear nuts of good size and quality, and both are very productive. The three varieties named are probably the best now obtainable. With good care, in favorable locations, grafted trees can be expected to yield a few nuts within four or five years from planting and a considerable quantity at six to ten years of age. They should not be planted in isolated locations; the proximity of trees of the same species adding materially to their fruitfulness.

Our conclusions may then be summed up as follows:

1. Recorded experience indicates that with the possible exception of the chestnut, the native nut-bearing species are unworthy of planting in Michigan for their fruit alone.

2. The large and increasing consumption of nuts makes further experimentation with introduced species advisable.

3. Trees bearing choice shagbarks and chestnuts should be carefully preserved and their product kept apart from inferior nuts for marketing.

4. The introduced nuts most promising to the experimenter are believed to be the improved varieties of the European and Japanese types of chestnut, the hardy, early bearing varieties of Persian walnut, and the filbert. The pecan is worthy of trial and will probably make at least a satisfactory ornamental tree if grown from stock secured north of the Ohio river. The almond blooms too early to make its trial advisable outside of the most favored portions of the fruit belt.

5. There is not sufficient evidence at present to warrant the extensive planting of any of these nuts in Michigan, but experimental work by growers should be encouraged in order that the limitations and possibilities may be determined.

Mr. B. Hathaway of Little Prairie Ronde: As to the difficulty of transplanting the shagbark, I have trees in bearing which I transplanted from my nursery, eight out of ten having lived without trouble. Last year I got two bushels of nuts from them besides what the boys took. They were transplanted at two years of age, when they had four or five feet of tap-root to one foot of top. Holes for them were dug with a post-hole digger, giving ample depth for the placing of the tap-root in its natural position. These trees have been planted eighteen to twenty years.

Mr. Lyon suggested the cutting of the tap-roots a year previous to the transplanting, but Mr. Hathaway objected to this as an interference with the natural habit of the tree. At two years of age they have very few lateral roots and are not likely to supply them if the tap-roots are cut.

BORERS THAT THE HORTICULTURIST MUST FIGHT.

BY PROF. G. C. DAVIS, MICHIGAN AGRICULTURAL COLLEGE.

APPLE TREE BORERS.

What is commonly known as the flat-headed apple tree borer is one of the commonest that we have. It is so named from the flat appearance of the head of the grub and can be told the flattened burrow which it makes. The grub may further be known by the anterior portion just back of the small head being enormously enlarged and rounded on the sides. But one year is required for the development of these borers and hence they grow rapidly and bore with equal energy to satisfy the appetite. They pupate in the spring in their burrows and come out as a beetle in early June.

FLAT HEADED APPLE TREE BORER (*Chrysobothris femoratus*): *a*, larva; *b*, beetle.

The beetles are great lovers of sunshine, and may be seen quietly basking on the sunny side of a fence, stump, or tree, or perhaps running very rapidly around as if in search of something, instantly taking wing if one tries to catch them with his hand.

Through June and July, the eggs are laid in crevices over the bark, and the young grub, like all others of this family of borers, has to gnaw its way through to get under the bark.

Besides working on the apple, this species is known to work on the cherry, pear, plum, peach, and most of our shade trees and shrubs. It is even more common in the forests than in our orchards, so that the species is not likely to become extinct for want of a food plant. As a general rule, in depositing their eggs, the beetles will select a tree that is not really thrifty or rugged in its growth. Small trees that have been recently transplanted are also sought for the same reason, and special attention should be given such trees to prevent the borer from taking undue advantage of them for a few years until they become as thrifty and rugged as the rest.

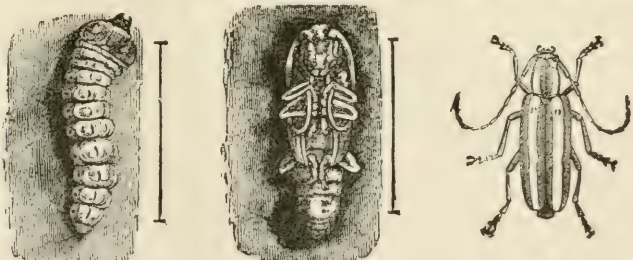
Dead, partly decayed, or badly injured branches should never be permitted to remain in an orchard, neither on the tree nor off, as they are ideal breeding places for the flat-headed borers. Such branches as these in an orchard not only breed the borers very rapidly, but attract others that are traveling. When the dead or sickly trees have been killed off, the beetles will attack the thrifty trees and they in turn will succumb to the beetle's work. Brush piles left in an orchard or vicinity are equally good harbingers of all kinds of borers as well as other vermin. I feel very certain that I am right when I make the assertion that no orchardist need worry over the flat-headed borer injuring his trees to any extent if he will keep his orchard in a healthy condition and keep all dead and dying limbs cut out and burned. So long as an orchard is kept in this condition there is nothing to attract the beetles and they will leave the orchard entirely alone and search for orchards more to their liking.

For the entire class of flat-headed and round-headed borers, alkaline washes of some kind serve nicely as a repellant. They seem to be unpleasant to the beetle and she will not deposit her eggs on a tree washed with them nor remain long on such a tree herself. Soft soap is generally considered the best wash, as it can be so easily applied and when once thoroughly dried upon the bark is not easily washed off. If a small amount of crude carbolic acid, perhaps one part to twenty parts of the soap, is used, this mixture will be even more effectual in repelling the beetles. Soft soap, as generally made, is a little too thick to use as a wash, but it should be diluted only enough to spread well and leave a soapy film over all the bark. It may be applied with a broom or scrubbing brush. Care should be taken to reach all crevices in the bark, as there is where the eggs are most likely to be deposited. The first application should be made early in June and, if the next few weeks are rainy, a second application should be made in early July. The base of the tree, near the surface of the soil, is the most likely to be attacked, but the rest of the trunk and the large limbs should also be washed as far up as can be conveniently reached, for the borer works there, too.

When at work under the bark, the borers may be detected by the chips pushed out of the opening. They may be dug out, but unless care and good judgment are used, one will dig such large holes in search of the borer that the knife will do more harm than the borer would if left alone. Hot water may be injected or a wire entered and little or no harm done to the tree, but it is usually quite difficult to reach the borers in this way and be certain that they have been killed.

THE ROUND-HEADED BORERS.

Another family of borers, that work on the sap wood mostly, are the round-headed borers. They belong to the Cerambycidæ, or long-horned beetles. The swollen portion just back of the head is nearly spherical and the borers make a round or oval instead of a flat burrow, hence the names of the two kinds. These borers, like the flat-headed ones, are footless and move in the burrow by alternately contracting and expanding the



a b c

ROUND HEADED APPLE TREE BORER (*Saperda candida*). *a*, larva; *b*, pupa; *c*, beetle.

body. There are several species that attack the apple, the most common being in the mature form a beautiful white, striped beetle known as *Saperda candida*. The eggs are laid in June and July, singly, over the bark, and the young grub hatches from them inside of two weeks. Instead of going through all the transformations in one year, three years are required for its development. While the actual work of the flat-headed borer does not last over six months, that of the round-headed

borer continues for more than two years. This length of time enables the round-headed borers to go much deeper and further, and although they are not so common as the flat-headed borers, their work is to be dreaded as much or more. The same remedies and methods of treatment are to be used as recommended for the flat-headed borer.

There are several other borers on the apple tree besides those already mentioned, but they are not usually common and their work is confined almost entirely to dead or partially decayed wood. If what has already been said about dead limbs and brush in an orchard will be heeded, there is no danger of serious loss from their work.

FLAT HEADED CHERRY TREE BORER (*Dicerca divaricata*).

FLAT-HEADED CHERRY TREE BORER.

Closely related to the flat-headed apple tree borer is another large species that works on cherry trees and occasionally on peach trees. The larva bores under the bark on the sap wood and can be readily told by the large flat head. The remedies are the same as recommended for the flat-headed apple tree borer.

PEACH TREE BORER.

The common peach tree borer, *Sannina exitiosa*, is seldom seen in the imago stage, and should it be seen it might very easily be taken for a wasp, as it has such a wasp-like appearance. In the grub stage it is too well known to need much description, and can readily be told by having sixteen legs. Unlike most destructive insects that we have, this one is of American origin and is unknown beyond our shores.

MOTHS OF THE PEACH TREE BORER (*Sannina exitiosa*). 1, female; 2, male.

The moths appear through July and August, and, after mating, the female lays her eggs singly over the trunk of the tree, usually near the ground When the eggs hatch, the larvæ may attack the body of the tree well up from the ground or even in the crotches of the limbs, though usually they work downward to a little below the soil or even to the large roots. The borers develop in one year, though very irregularly. The full grown larvæ measure over half an inch in length. Fortunately the peach tree exudes a copious supply of gum when injured and a borer can be easily located and killed.

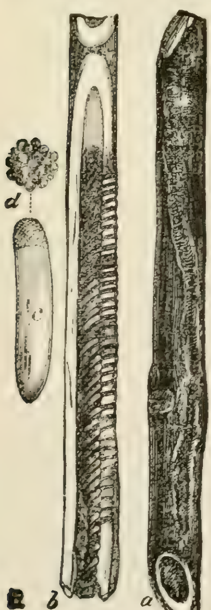
It probably is needless for me to dictate to a practical peach-grower, who has fought the borer for years, what to do, yet it does seem that a prevention of some kind would be more practical and less injurious to the trees than cutting or wiring the borers out after they have spent from two to eight months in boring the life out of a thrifty tree. The boring, cutting, and bruising of a tree must hurt it more or less each season, and many a tree loses its life by combined boring and probing. If the soft soap and carbolic acid mixture could be used about the first week in July, and then a month later, would it not be much better, and keep the tree entirely free from borers? Another means of prevention that I should like to see thoroughly tried in Michigan is to whitewash the trunks of the trees down to the roots with lime containing Paris green

enough to give it a faint green tinge. This is meeting with good results in many peach orchards in the east. The theory is that as the young grub hatches from the egg and commences to gnaw through the bark, it eats enough of the poison to kill it. One thorough whitewashing about the first of July would be enough for the year, and it looks to me like the simplest and most practical method we can use.

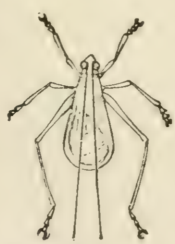
SHOT HOLE BORER.

On several occasions the past few years we have received specimens from South Haven of peach tree trunks killed by this minute beetle. The beetle is closely related to the clover root borer that is killing all our clover in central Michigan. Like the clover root borer, too, it selects thrifty, healthy plants for its work. The holes made in the bark remind one of a charge of fine shot having been fired into the tree. The first effect noticed is of the leaves turning yellow as in a tree suffering from peach yellows, and the leaves will drop off, the bark will crack, and the tree gradually dies. The beetle is said to be much more common on elm trees than on the peach. According to Harris, in his "Insects Injurious to Vegetation," it completes its transformations in August and September. We have taken it in early June at the college, and I am inclined to believe that this is nearer the time when the beetles appear. They then bore into the bark and the females lay their eggs singly along the chambers cut in entering. They work on the trunk and larger limbs.

Nothing has ever been done, to my knowledge, in the use of remedies, but I am very sure that the same poisoned whitewash as recommended for the common borer, when applied before the beetles enter to deposit eggs, would catch them the same as the young grubs of the borer. Trees that are already bored by the beetle and show signs of injury or death should be cut out and burned at once to kill the occupants and prevent their escape to attack other healthy trees.



SNOWY TREE CRICKETS.

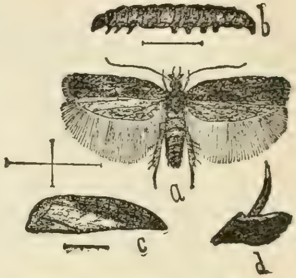


Snowy Tree Cricket; also canes showing injury—*a*, as seen from the outside; *b*, showing eggs when cut open.

Sometimes snowy tree crickets will become numerous enough to injure young peach twigs by laying their eggs in a row along the twig. The white eggs are somewhat curved and are put into the twig close together, often extending in a row for several inches. This can be seen nicely by splitting the twig lengthwise along the dead crack. The reason the tree cricket is spoken of here among borers is, that every little while people send me twigs containing the eggs and want to know what grub it is at work in the limbs. Crickets do the trees little harm, as they do not feed on them, merely laying the eggs there in the fall for winter protection. The snowy crickets are lovers of weed patches and will seldom bother cultivated plants if the weeds are well subdued in an orchard. Cutting off the injured twigs in the fall or spring and burning will rapidly deplete their numbers.

PEACH BUD AND TWIG MOTH.

The peach bud moth for the past few years has been the worst peach tree enemy in many localities that we have had. The young caterpillar hatches from the egg in the spring as the buds are swelling, and it immediately begins operations by boring down through the young bud into the end of the tender twig which is soon eaten out so that it dies. The little dark brown caterpillar then attacks another bud in the same way, and before long half the buds on the tips of the twigs are killed. The caterpillars are reddish brown with black heads and are less than half an inch long when full grown. They continue to bore into the ends of the twigs until the leaves are entirely out on the trees, but the greatest injury is done when the buds are young and tender. If the trees are watched carefully, and as soon as the work of the bud moth is seen, one of the arsenite sprays is used, it will literally and figuratively "nip the intruder in the bud." The arsenites should be used at the rate of perhaps one pound to 250 gallons of water and should never be used uncombined. An excellent plan would be to use with the Bordeaux when applying the early spray for leaf curl, peach rot, shot-hole fungus, and other fungous diseases of the peach. When the Bordeaux is not used, lime alone may be substituted.



PEACH BUD AND TWIG MOTH. *a*, moth; *b*, caterpillar; *c*, pupa.

PEAR TREE BORERS.

The pear tree has quite a number of species that bore in its trunk and limbs, but none of them are very abundant. The trunk is attacked by a small Sessid borer (*Sesia pyri*), closely related to the peach tree borer. The work of the two is alike in most respects and the remedy is the same.

PEAR-BLIGHT BEETLE.

Sometimes we find that the blight of the pear tree is caused by a company of little beetles, each of which is not more than an eighth of an inch long and no larger than a pin head. The beetle lays its eggs at the base of the bud, and when the egg hatches, the young grub bores inside toward the pith. By early July the grub has reached its growth, transformed and appeared as a beetle. These little dark brown, hard-shell beetles will attack a sound, healthy tree as readily as a sickly one.

PEAR BLIGHT BEETLE; a, male; b, female.

Generally, pear blight is caused by a bacterial disease which is not the work of any insect. When blight appears, the twigs should be examined to see whether it is the work of the disease or of an insect. If it is the work of an insect, the bark will be perforated over the twigs with little worm holes. If twigs are split lengthwise and no worm holes found in the inside wood, one may be very sure that it is the disease and not the borer. The only

remedy that we know of for the pear-blight beetle is to cut and burn the limbs as soon as they show signs of death. This will kill the young borers before they can mature.

GRAPE-VINE ROOT BORERS.

The roots of the grape vine are subject to the attack of two root borers, neither of which is usually common. One of them is a giant grub that requires about three years for it to grow and is from two to three inches long when full grown. This grub is yellowish white, with reddish brown head and a bluish line down the back, and developes into a large, brown, long-horned beetle. The root is often almost entirely eaten up by the grub before the vine dies. Vines are often sickly without any noticeable disease or injury above ground, and people often wonder what causes their vines to be sickly. When vines die suddenly, without any apparent cause, the roots should be examined to see if these borers are working in the center of them, and if so the grubs should be killed.

The other borer is smaller—not much larger than the peach tree borer, which it resembles in appearance. Another difference is that the giant borer has only six legs, while this one has sixteen. This borer, known scientifically as *Sciapteron polistiformis*, works mostly outside on the bark and sap wood. When mature, the grub transforms into a wasp-like moth which in turn lays eggs around the collar of the vine for the next generation. Mulching or mounding the vines with coarse manure or some similar mulch will greatly deter the moth from laying her eggs and will also be an aid to the vines through dry weather.

RASPBERRY BORERS.

There is a borer that occasionally attacks the roots of the raspberry, but the only two insects of which I shall speak are those that work on the young canes and shoots. The work of either of them will be quickly noticed by the wilting of the canes, in June and July, some distance down from the top but not clear to the ground.

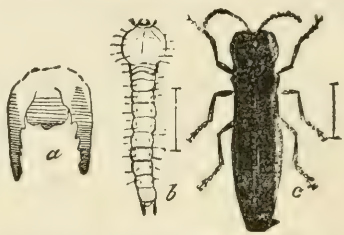
One of the girdlers is a slender female beetle which cuts two circles about an inch apart and between these circles lays an egg in the cane. This prevents the growth of the cane crushing the egg before it hatches. The young borer works down into the cane, through the pith, and usually kills it before the next spring, The borer by fall is nearly an inch long, slender, shining, dull yellow, with a dark brown head. The beetle which comes from it the next spring is about half an inch long, slender, dark brown, with a reddish yellow thorax on which are two or three dark spots.

The other girdler is a new pest to the raspberry, whose name we have not yet learned. It works entirely on the young shoots springing from the roots. It is a little white maggot with black jaws and bores an irregular channel down through the center from near the top. When a few inches from the ground, the maggot girdles the shoot on the inside so close to the outside bark that it can be seen at work through the bark. After the shoot is girdled, the maggot continues its way downward toward the root. The maggot is closely related to the cabbage maggot that works in the roots of cabbages and radishes. It is elongate cone-shape, and is not a quarter of an inch long when it does the girdling.

The best means of protection that we can recommend for either of these girdlers is to watch for the wilted shoots and cut them off some distance below where they wilt, and burn, or destroy the injured part.

GOUTY GALL OF THE RASPBERRY.

The raspberry gouty gall is an irregular swelling of the raspberry canes, caused by an insect known as the red-necked agrilus, or *Agrilus ruficollis*. Occasionally the beetle becomes numerous enough in some berry patches to need close attention, but not often. The swellings on the canes are quite noticeable, the bark becomes roughened and cracked, much like it does in anthracnose, and when split through the swelling little burrows with slender, yellowish white borers will be found. These borers will appear in June or early July as small slender beetles with the characteristic red collar. The galls should be cut out in early spring and destroyed before the borer can mature and escape.



GOUTY GALL OF THE RASPBERRY, AND THE LARVA, *b*, THAT MAKES IT; *c*, beetle.

CURRANT BORERS.

There are at least three species of currant borers. The most common one, *Sesia tipuliformis*, is closely related to the peach tree borer, and is a very serious drawback in currant culture. The other two are larvæ of longicorn beetles. They are not so common, and, as their work is the same, all three will be treated at once.

NEW CURRANT BORER.
(*Hyperplatys maculatus.*)

COMMON CURRANT BORER (*Sesia tipuliformis*), showing larva, pupa and moth.

AMERICAN CURRANT BORER
(*Psenocerus supernotatus*).

The eggs for the future borers are laid in June on the stems at the axil of some twig or leaf, and as the egg hatches the young grub bores inside the cane. Here they continue to bore until the following spring, when they transform and soon issue as the mature form, which in the most common species is a small, clear winged, wasp-like moth. By spring the canes will have been pretty badly bored inside and are usually slower in leafing out than the rest. By going through the currants at the time of leafing out, and cutting out all the injured canes that can be found, fully three fourths of the affected canes can be collected and the borers destroyed. If this is repeated every year the borers will soon be so reduced in numbers that they will do little harm.

In addition to this paper, Mr. DAVIS said he had never been able to find in Michigan the true squash vine root borer. Many samples of injured vines had been sent him, but none of them had been affected by either the root borer or the big black bug, but by a bacterial disease or a fungus. The bacterial disease may be prevented by use of lime or carbolized lime. The disease is carried from vine to vine by both bugs, the little one especially. If we keep these off we will save the squashes. The little white worms in the squash roots, spoken of by an inquirer, were larvæ of the striped beetle. These are very destructive, but those who have thought them the true root borer are mistaken. Sprinkle lime or carbolized lime over the leaves and about the roots. The latter is made by using in a bushel of lime one half to three fourths of a teacupful of crude carbolic acid.

Mr. MORRILL thought this mixture too strong for use about melons; that a quarter cupful of the acid would be enough. Mr. DAVIS thought quite possibly this was true.

Mr. J. G. RAMSDELL said, as to the currant borer, that the only way he knew of to subdue it is to cut off one half of the season's growth, and so discover and kill the borers, but this is hard work and destroys much of the crop.

Mr. M. E. WILLIAMS: This is a very important matter. If, as Mr. DAVIS says, this borer can be detected by the later leafing of affected stems, it will be a great aid.

Mr. DAVIS: This means of detection can not always be relied upon, but in two thirds of the cases the presence of the borer may be detected in this way. It looks as though it is doubtful if any remedy save cutting can be used, except to destroy the eggs, for the larvæ bore in and stay there.

Mr. MORRILL: I find this really a very reliable cure. I found the Red Dutch peculiarly subject to the borer and so I took that variety out entirely. In the spring I take out every branch that is not leafing properly. I go again later and catch all the rest. I burn all the brush cut out.

This work costs me $7 to $10 per year on a twelve acre field, and latterly I have found very few borers. It is a practical remedy, as I have found by experience.

Mr. HATHAWAY: What effect has whitewash alone on the apple tree borer?

Mr. DAVIS: There is not much value in lime alone. Its use in the formula is to keep the arsenic spread over the tree.

Mr. HEIGES: The best remedy we have found is white lead and boiled linseed oil, mixed to the consistency of country cream (not the city sort), to which is added one ounce of strychnine to the quart. Remove the earth from the crown and paint the crown. This remedy is of proved efficacy. It is more durable than mixtures of Paris green. As to the cucumber beetle, turpentine in dry, unleached ashes or plaster, placed about the vine (not upon it) will certainly repel both the striped beetle and the black bug. The latter works upon the under side of the leaves, and so it is of no use to put anything on top of them to kill him. To kill the asparagus beetle, which is a very serious pest, cut off and burn the matured growth.

Mr. MORRILL: called the attention of Prof. DAVIS to the San Jose scale. Mr. DAVIS said it had only recently been discovered in the eastern states, but already it is to be found in New York, New Jersey, Missouri, and Maryland. It was first taken to New Jersey in nursery stock from California, and these trees were sent into almost every state in the Union. It is worse than all our other pests combined. In form it is a small gray scale with brown center and reddish rim, and is perhaps one eighth of an inch in diameter. There is a live insect under the scale. It first appears upon the leaves and twigs and then upon the fruit. Watch carefully for it upon nursery stock. This scale does not travel very fast of itself, but is likely to be sent everywhere with nursery stock. The remedy so far known is fumes of cyanide of potassium applied under a tent covering the tree, but this can only be used in a limited way. Kerosene emulsion is of some service, but it takes a long time to subdue the insect in that way.

Mr. PACKARD said he thought he had the small borer referred to by Prof. DAVIS. The latter said it is known only in Massachusetts and Michigan, appearing in an orchard, destroying some trees and disappearing. Mr. PACKARD said he sent samples of the borer to Cornell, the agricultural department at Washington, and to Michigan Agricultural college, and received a different report from each.

Mr. HEIGES: I will send a bulletin on this scale to all who may desire it. It is one of our worst pests. It may be found in lilacs, sometimes,

and if you find it there it is very likely to be in your orchards also. I do not know how it travels

Prof. DAVIS: The San Jose scale is not likely to travel on the fruit, and the fruit does not return to the orchard. Birds may carry it while it is young, by its crawling upon their feet. It may also be disseminated by scions. The young will travel but two or three feet from the parent before settling down for life. It could not travel over ground.

QUESTIONS, DISCUSSIONS, REPORTS.

NEED OF A NEW POMOLOGY FOR MICHIGAN.

Taking up the subject of "Need of a New Pomology for Michigan," which was to have been treated in a paper by Mr. B. HATHAWAY of Little Prairie Ronde, the society listened instead to a brief address by the same gentleman.

Mr. HATHAWAY said he was impressed many years ago with the need of a new pomology for this state, especially for new varieties of the apple, having noticed that the kinds which were at first set and were successful were so no longer. The first test made by severity of winter had affected southern Michigan and Indiana as much as it did Illinois and Iowa, and so decimated his varieties that he could show at fairs but fifty kinds instead of the hundred he before had been able to show. The next such winter left only twenty, and the number has been no better since. The Iowans sooner appreciated the situation than did the pomologists of Michigan, and set about making a new pomology, and such was their success that at the World's Fair their display by far exceeded ours. The warnings spoken by Mr. HATHAWAY and others passed unheeded, but now their position is conceded by every intelligent horticulturist. "Michigan is all right for fruit," is a familiar expression. So it is, but the old sorts of fruit are not now right for Michigan. That is the point.

Mr. HATHAWAY read letters from several gentlemen in the west, giving names of varieties successful there. One of these was from Mr. W. A.

SPRINGER of Fremont, Wis. He said that the varieties most successful in his vicinity are Oldenburgh, Tetofsky, Haas, Walbridge, and Wealthy, and thus continued:

I do not consider the Russians the coming apple for the northwest. I am not familiar with the Russian varieties, but I never saw a good show of Russians at any state or other show of apples. No doubt some are good but I do not believe there is a Russian that, tree and fruit, will come up to the Wealthy, McMahon, and several other new apples (seedlings). The Oldenburgh, I believe, is German. Its seedlings have proven better in some respects than their parent. Some are good keepers and have as good trees. The Alexander (Russian) has given some good seedlings, better in quality and better in tree. They do not blight. But there are many chance seedlings that in fruit-bearing, quality, size, and beauty equal any Russian I ever knew. As for double working, I do not approve of it. In the first place, trees would have to be sold at three prices to make it pay. (2.) Most trees fail in the crotches, and if grafted below would spoil in the crotches. If, for instance, you used a Virginia crab for stock and then grafted in the limbs near the body, it would make a good tree, but the price would be high at which you could afford to sell. I would prefer the Virginia to any other stock.

Mr. S. I. FREEBORN of Richland Center, Wis., reported, as the varieties bearing best in that part of his state, the following, in order of fruitfulness: McMahon, Wealthy, Titovka, Hibernal, Talman Sweet, Haas, and Fameuse. Considerable trouble with "top blight" was reported. It was worse than ever, having begun immediately after the "cold spell" of June, and was worst on Alexander. "Some of the Russians are blighting badly, but no worse than American varieties, except Alexander." Continuing, Mr. FREEBORN said:

I still have great faith in Russian fruits as something to build upon in this cold climate for they are far beyond the American varieties for hardiness; and not only in apples, but in pears, plums, and cherries as well. There are many kinds of Russian apple which seem to blight hardly any. The Longfield is one of them. I could not at this time give a list of the blighting and non-blighting kinds. We have new and promising seedlings, notably those raised from Switzer seed crossed with Oldenburgh. I consider the Hibernal and Enormous the most promising kinds to use for stocks for top-grafting, of anything I am acquainted with.

The third letter was from Mr. O. F. BRAND of Faribault, Minn. He said the pomologists of his state had not yet been able to find any apple among the Russians having leaves, bark, and buds adapted to their climate of extreme changes. "They are evidently short-lived and can not be depended upon." Mr. BRAND was enthusiastic in commendation of the Peerless as the only kind resisting blight, which he reports as being worse

than at any other season. "The Euranda crab is the only one bearing a heavy crop of perfect fruit. It is a seedling from Transcendent, and does not blight. It is of the size of Transcendent, golden yellow with red cheek. Of plums the best I know is a seedling of either Weaver or De Soto. Our future orchards will be of our own native varieties. Reproduce from the best two if you wish to improve. Neither the old nor the young Okaberas are satisfactory."

"While it is evident that Mr. BRAND is enthusiastic concerning a single variety," said Mr. HATHAWAY, "he is right in his idea as to where we should look for the origin of new varieties." Mr. HATHAWAY, in further illustration of the way the earlier successful kinds of apple had failed in southern Michigan, told of the Red Canadas over three inches in diameter which he was at first able to produce, but the trees from which they were taken have since those severe winters produced scarcely a peck. The Spy went the same way, though holding out longer than any other kind. He had used a row of 100 Wageners to support a wire fence, though latterly he had taken some fruit from it. The Golden Russet had the same fate. On one occasion he spent an hour trying to convince Director Willits of the state experiment station that a sub-station for southern Michigan should be established, in order to test new varieties of hardy fruits, but was wholly unsuccessful. So he went home and set 200 Northern Spy for stocks, and got western seedlings and Russian scions, and now has about forty varieties in test. He also procured some southern varieties, some of which prove hardier in leaf and trunk than our own old-time kinds. The Peerless, about which Mr. BRAND is so confident, is promising with Mr. HATHAWAY. "The practice of some of the western men, of getting money out of such varieties, hinders progress, but the time of their adoption is surely coming. In five years more I expect to be able to show valuable results; but the testing of apples is necessarily a work of slow progress."

THE SEASON AT THE EXPERIMENT STATION.

Mr. T. T. LYON spoke of some results and observations of work at the experiment station the present season. Because of the two exceedingly dry seasons, the growth of some varieties and classes of fruit are not what they would otherwise have been. The extremely wet spring of two years ago hurt the small fruit plantation so that it must be removed and a new one made. It has been the practice for two years to spray everything before the leaves start as well as later, and the results have been in all respects satisfactory. The effect of spraying the peaches and plums has been wholly good but the storm of March and the later bad weather, prevented fruitage. The bloom of the Japan plums was ruined by frost,

so these show but very little fruit. Yosebi ripened at middle of July and Ogon a little later. This is of poor quality and growers would better let it alone. Some fruit from American varieties have been obtained but there is very little use for these where the varieties of Domestica can be fruited, unless exception may be made of one or two varieties. He commended trial of the Keswick. It has borne ten times as much fruit as any other variety; and while it is worthless for the table it is excellent as a culinary fruit. The Titovka a Russian sort, is of two shades of brilliant red, large, and of good form. He commended the Yellow Transparent. It ripens at the time of the old Early Harvest and its tree is very vigorous. The pear plantation, as indeed the apple also, was made without reference to experiment station work, and was designed to contain the cream of varieties for family use. Both these were planted before the station was established. Mr. LYON spoke well of the Wealthy apple, but said it would be a September fruit here, which is an objection to it because we have enough such kinds now. It will be hardy anywhere in Michigan. He commended the work of Mr. Hathaway, but said he suspects the trouble is more with men and methods than with the climate or varieties. There is general lack of cultivation and fertilizing of apple orchards. The new varieties are likely to go the way of the old ones and go for the same reasons.

IN GEORGIA.

Mr. W. L. GLESSNER of Macon was present, being commissioner of immigration for a Georgia railway system. He told wonderful tales of the fruitfulness of the lands of that state and of the profits made from growing peaches and other fruits, and solicited a visit and examination from northern pomologists. He said there was no curl-leaf in Georgia nor had there been curculio until last year. Peach trees bear paying crops the third year. As fertilizers, use is made of acid phoshates, bone, and cotton seed meal.

THE ELBERTA PEACH.

Inquiry having been made as to this variety of peach, Mr. MORRILL said it was conceded to be hardy and of excellent quality but was subject to curl-leaf. However, as this can now be controlled, the Elberta will prove the best accession in many years, save the Kalamazoo. These two are likely to supplant the Crawfords.

SPRAYING FOR CURCULIO.

Some discussion arose over the matter of spraying for curculio, some expressing the opinion that it was not effectual, while others, including

Prof. HEIGES, were sure that it was. Those who were doubtful were under the impression that the insect does not eat the foliage and therefore can not be poisoned by the arsenic. But to this Prof. DAVIS responded, assuring that the curculio does eat both of the plum foliage and fruit.

He therefore is subject to the operation of the insecticides, which accounts for the experience of those who have grown crops of plums by aid of spraying alone.

PEAR BLIGHT CONTAGIOUS.

Prof. TAFT was asked if pear blight is contagious. His answer was, yes. It is a bacterial disease which may be and is carried by insects from flower to flower and otherwise.

EXHIBITS.

Your committee would report that they have examined the exhibits and found the following:

The only exhibit of vegetables was a large collection grown on the trial grounds of the Haven Seed Co. of South Haven, many of which were well grown and carefully selected. They were grown without artificial watering. It included ten varieties of potato, seven of turnip, ten of cucumber, ten of beet, besides carrots, radishes, peppers, tomatoes, and exceptionally fine egg plants. This collection added much to the appearance and interest of the exhibit, and the Haven Seed Co., are to be commended for their enterprise in making it. Among the fruit exhibits we noticed a particularly fine basket of Lewis peach from R. MORRILL, and others from HUMPHREY and MONROE BROS., and CLARK SHEFFER, and plates from A. S. PACKARD and O. F. DEAN. St. John (Crane Yellow) is shown by A. S. PACKARD and O. F. DEAN, and there are also a number of plates from other parties whose names are not known to your committee. JOHN MILLER exhibited a fine platter of mixed peaches. There were also a number of plates of apples, pears, and plums, most of which were large and fair, but without the names of the exhibitors.

The fruit table was embellished by a platter of beautiful flowers arranged by Mrs. MARY HARRINGTON.

C. D. LAWTON,
J. F. TAYLOR,
L. R. TAFT.

RESOLUTIONS.

Resolved, That the thanks of the Michigan State Horticultural society be tendered to the members of the South Haven and Casco Pomological society, and to the citizens of South Haven, for their kind hospitality; and that we desire also to acknowledge our appreciation of the music furnished by the Ladies' Marine band.

Resolved, That our thanks be returned to Gov. RICH and Congressman THOMAS for kindly consenting to address our conventions; to Prof. HEIGES of the division of pomology at Washington, who contributed largely to the interest of our sessions; to Hon. T. T. LYON, for his kindness and attention to those visiting the experimental grounds; and especially to those who brought the many specimens of fine fruit and vegetables which added greatly to the interest of the meeting.

A. H. SMITH,
F. J. RUSSELL,
ED. HAWLEY.

PROCEEDINGS OF THE ANNUAL MEETING.

HELD AT LOWELL, DECEMBER 27 AND 28, 1894.

ONE of its most successful meetings was the 24th annual of the Michigan State Horticultural society, held in Lowell, December 27 and 28. There has been a markedly larger attendance at each of the meetings of the past three years, but only on one occasion, that of the winter meeting of 1894, at Charlotte, has the attendance been so great as it was on this occasion. At each of the sessions there were from 300 to 400 persons in attendance. While the number from Lowell and vicinity was large, there were many from abroad in the state. Considerable delegations attended from the West Michigan Fruitgrowers' and Grand Rapids Fruit Shippers' societies, as well as from many of the local societies of the western and central portions of the state.

Reports of the secretary and treasurer showed the society to be in sound financial condition, the life membership fund having been reinvested during the year by Mr. C. W. Garfield, who acted as treasurer in place of Mr. E. H. Scott, elected to the office in 1893.

President Weekes of Lowell village made a brief address of welcome to which Mr. C. W. Garfield responded. Mr. Weeks having said something concerning the value of the society's work in ornamental horticulture and floriculture, Mr. Garfield replied that he was always glad to respond to an address which recognized not fruit alone, but floriculture and features which provide for the home. Mr. Tracy has recently said the society did good work in urging the adornment of school grounds, a few years ago; that he hears from it every year, love for the flowers having grown among the communities where they were placed. In this the society did a good and benevolent work. It is pleasant to know that we are not exclusively devoted to money-getting.

Messrs. D. W. WILEY, R. M. KELLOGG and A. S. PACKARD were made a committee to examine and report upon the reports of secretary and treasurer.

Other committees were these:

Resolutions—Messrs. C. W. FARFIELD, D. W. WILEY, and R. M. KELLOGG.

Fruits and Flowers—Messrs. L. R. TAFT, T. T. LYON, A. S. PACKARD.

Implements—Messrs. W. W. TRACY, THOMAS WILDE, C. J. MONROE.

The society having decided to have a committee to report a ticket of officers for the ensuing year, elected Messrs. W. W. TRACY, W. K. MUNSON, and R. M. KELLOGG, for that purpose. Their report was unanimously adopted, and the chairman directed to cast a ballot as follows:

President—ROLAND MORRILL of Benton Harbor.

Secretary—EDWY C. REID of Allegan.

Treasurer—ASA W. SLAYTON of Grand Rapids.

Members of Executive Board—C. J. MONROE and T. T. LYON of South Haven.

Chairman TRACY, after warmly speaking the feelings of the society and himself toward Mr. LYON, gave notice that at the next meeting the committee would report an amendment to the constitution by which Mr. LYON would be made honorary president and member of the executive board for life.

Mr. LYON asked for reconsideration of the report, so far as himself was concerned, pleading that the infirmities of age should excuse him from further labors. But no one would have it so. He was told by several speakers, each of whom was applauded in his declarations, that the society had no honors too high for his deserts, and none which it is not anxious to bestow upon him; that it was his counsels, not his labors, that were wanted and could not be dispensed with.

Mr. HENRY AUGUSTINE of Normal, Illinois, president of the Illinois State Horticultural society, was in attendance, and was by motion made an honorary member of the Michigan State society.

President WILEY of the West Michigan Fruitgrowers' society, presided at the session of the forenoon of the 28th.

Upon motion of Mr. MORRILL, the society instructed the secretary to send Governor RICH its indorsement of Mr. C. J. MONROE for member of the State Board of Agriculture.

Messrs. R. L. TAFT, and C. J. MONROE were elected delegates from this society to the meeting of the American Pomological society, to be held in Sacramento, California, January 16-18, 1895.

The session of Friday evening was made more enjoyable by orchestral music by a number of Lowell young men under direction of Mr. J. H. Rickert, and a song, "In Old Madrid," by Miss Hattie Wilson. Both performances were very much above the average work of the amateur musician, and elicited the warmest commendation of the audience.

Messrs. R. Morrill, C. W. Garfield, and C. J. Monroe were appointed a committee to attend to passage of such legislation as may be proposed in the interests of horticulture by the legislature of 1895.

The secretary was instructed to send a copy of the resolutions adopted by the society, to each member of congress from Michigan.

At the close of the meeting a vote of thanks was given the people of Lowell for their hospitality; Mr. Augustine invited attendance upon the next annual meeting of the Illinois State society at Kankakee; Mr. Wiley invited attendance upon the annual meeting of the West Michigan society in Grand Rapids, the last Tuesday in February, and the committee reported that they found the affairs of the secretary and treasurer in proper order.

PAPERS AND DISCUSSIONS.

ORCHARD IRRIGATION.

BY MR. M. B. WILLIAMS OF KALAMAZOO.

It has been said of some one that "his future is behind him." The converse of this would be nearer the truth concerning my experience in irrigation; and, instead of my future being in the past, it might be more properly said that my past experience is yet to come, and it would seem less presumptuous for such a person to remain silent or speak only to ask for information, were it not for the fact that most Michigan horticulturists probably feel much the same, owing to our common lack of practical knowledge in this matter.

But there is one thing about it which some of us know, and we know it thoroughly, viz.: that in seasons like the past we need some way of supplying more water to our orchards, and these dry periods that have come at some time during almost every season for nearly or quite a decade of years past, have caused an interest and inquiry concerning practical methods of irrigation to extend far outside the limits of what is sometimes spoken of as arid America. But the inhabitants of this district, having

the knowledge that comes from experience, are naturally turned to for information on irrigation.

Being interested, both as a fruitgrower, in the problem of how best to get water on our orchards, and as a manufacturer and dealer in windmills, tanks, and other water-supply goods, I determined, soon after the meeting of this society at South Haven, last summer, to attend the assembly of the National Irrigation congress which met in Denver early in September; and as this has been alluded to as a reason why I should undertake to speak on this subject, you will excuse me for assuming that some here may be as ignorant as myself, while attempting to relate a few of the things seen and learned there.

The National Irrigation congress is, as its name indicates, a body of men interested in means and methods of practical irrigation, coming from all the states and territories where interest enough is felt to appoint delegates, none, however, but regularly appointed delegates being allowed to vote or take part in their discussions, except by courtesy or common consent. Delegates may be appointed by the governor of any state or by any state society or organization cultivating the soil, and therefore interested in irrigation—such, for instance, as this society—and a certificate of such appointment would constitute proper credentials. Three annual meetings of this congress have been held, the first in California in 1892, the second in Utah, and the third in Denver, Colorado. The fourth is to be in Albuquerque, New Mexico, some time in 1895. The time of the congress is occupied with papers and discussions on topics connected with irrigation, some of them being quite spirited, especially on resolutions pertaining (as many of them did) to legislation, both state and national, that was either really needed or supposed to be.

Adjacent to the building where the meetings were held was an exhibition of machinery and appliances for raising and distributing water for irrigation, consisting of windmills and pumps, steam and gasoline engines, tanks, and other devices, each being the greatest thing in the world, according to the statements of the exhibitors.

But one of the most interesting features of all was what they called the itinerary of the congress, or what might be called the excursions for the purpose of witnessing the actual working of irrigation in various parts of the state. On one of these excursions a special train took about two hundred of the delegates to Greeley, in the northern part of Colorado, one of the greatest (if not the greatest) potato producing points in the entire country. Carriages were at the station to take all, free of charge, whereever they wished to go, and we rode for miles over a country where nearly entire farms were devoted to potato-growing, and where everything, although in the midst of a so-called arid region, was fresh and green, much more so than in the humid (?) state from which I had come.

The method of irrigation at Greeley is the canal, or, as it is sometimes called, the gravity ditch system, water being taken from some place higher than the land to be irrigated, usually several miles up the river or stream that supplies it, and being conducted in a canal around the bases of the hills, and the tops of depressions, keeping it at the proper elevation to insure a good but not too rapid flow, and in a direction gradually diverging from the main stream, until it is often several miles from the latter and flows at an elevation very much higher, and perhaps several thousand acres are embraced between the two, the general slope being toward the main stream, although this slope is not, as some suppose, always even, but,

by following the same method that enabled them to get the main canal on comparatively high ground, they can flow water to all parts of their land, although in places it may be quite undulating, providing no point is higher than the main canal. In passing over this country one often finds streams that appear to be flowing up hill, or in places where it seems as though they must have flowed up hill to get there.

From the main canals are taken laterals, and these again are divided and subdivided until each farm receives its portion, which is carefully measured out by methods that are both simple and effectual. These canals and ditches and the apportionment of water are all under the control of a superintendent, who is paid, as also are the expenses of keeping the ditches in repair, by a tax in proportion to the amount of water received by each, which tax generally amounts to but little where the farmers own and operate their water rights; but, where large ditch companies control them, the cost of water is usually much higher. In those irrigated regions a water-right is as valuable and inseparable from a good farm as the buildings, or even more so. In fact, the comparative value of land and water seems the reverse of what it is in Michigan. Here, if anyone contemplates engaging in agriculture or horticulture, he first secures a piece of land and then thinks about water afterward, or takes what falls without thinking about it at all; while there they first look for a good water supply and then find some land to put it on. We were told at Greeley that an eighty-acre water-right was what water would flow through an opening ten inches wide and five inches deep. This amount is spread over a portion of the land at a time. If, for instance, the farmer is irrigating potatoes, he turns the water to as many rows as will absorb it all, and when they are sufficiently wet it is turned off from that part of the field and to another.

In irrigating alfalfa or similar crops not grown in rows, furrows are plowed across the field every few rods in the direction the ground slopes, and water is turned into these furrows and allowed to fill them, and in this way the entire piece is flooded. After the water is turned off and the ground has become sufficiently dry, the furrows are turned back, harrowed or cultivated down, until smooth enough for passage of the mower and other machinery used in harvesting the crops.

The methods above described for distributing water over crops, whether in rows or not, is practically the same, either in irrigating potatoes or alfalfa, or orchards and fruit or other crops, and is also much the same by whatever system or source the water may be obtained, except, however, that where only a samll amount of water is pumped a reservoir should be used to collect sufficient to fill the furrows more rapidly, as it would not be practicable to flood land or even to irrigate between rows with too small a flow of water because the ground, if capable of absorbing it at all, would absorb too great a portion near the source of supply, while the more distant ground would receive but little or none.

After leaving Greeley our company stopped next at Fort Collins, where the Colorado Agricultural college is located, but our stay there was brief, and much more time could have been spent with interest and profit; but, having two other stops to make, at all of which carriages were waiting for any who wished to ride around, our time in each place was necessarily limited. The last stop was at Boulder, and our train returned to Denver in the evening.

The next day was given to convention work, and the following evening another special train took the congress and visitors to Rocky Ford in the

southern part of Colorado, where we arrived the next morning, that being one of the festal days so common in that section, when the people come together from all the surrounding country, by train loads. That particular occasion was what they called melon day, when thousands of watermelons and muskmelons are given away to any who wish to eat them. They had also an exhibition of fruits and vegetables, all showing what could be produced under irrigation. After dinner we rode several miles to the farm of a fruitgrower and nurseryman, where for the first time I saw an irrigated orchard in bearing, the trees being loaded with fruit, and water trickling in furrows between the rows; and as I thought of the thrifty orchards in our own state, growing (as many of them do) near running streams, or in sight of the plenteous waters of Lake Michigan, I wondered if necessity, which is said to be the mother of invention, was not also the mother of enterprise, and hoped that before the necessity grew on us much greater we might manifest some of the same enterprise which was bringing such pleasant results to the people of that country.

Another of the excursions and festal days in which we participated was at Grand Junction, in western Colorado, and on the Pacific side of the mountains. This was called peach day, and peaches were given away the same as melons at Rocky Ford. The exhibition at this place was almost entirely of fruits, and, though I have seen much larger collections, I never saw nicer-appearing fruit; and, selecting one exhibit that was particularly fine, arrangements were soon perfected with the owner for visiting his place, which was done the next day. Here, on about twelve acres of ground, all under irrigation, were growing peaches, apples, pears, plums, grapes, and other fruits, and an excellent opportunity was enjoyed for studying the peculiarities of fruitgrowing in that country.

Our time is too limited to tell about fruit day at Canyon City, where nearly all kinds of fruit were given away, or of the numerous other places visited, for probably some of you are becoming weary of these wanderings in the "Great American Desert," and have been wishing the speaker would come back to Michigan and tell us about irrigation here; but it will not take a long time to tell all he knows on that subject, and so we will stop on our return at one more point long enough to look into another and perhaps not the least interesting method of western irrigation viz.: by means of windmills. When at the Denver meeting we often asked about this method and for a time were somewhat puzzled over the contradictory answers received. A man from Colorado or other mountainous state would tell us in substance that they were too small and insufficient to be of any value, while another, from some state like Kansas, would reply that windmills were a very decided success, and often give names of prominent men using them for irrigating from five to twenty acres of ground. But we soon discovered that the difference in opinion was simply the result of different conditions. The man living where elevation was great, usually had to go deep for water if pumped from wells; and besides he could take gravity ditches from swift-running streams, and what need had he of windmills or anything else to pump water, when it could be flowed directly upon his land? Those having an inexpensive or insufficient supply of ditch water, or none at all, and in a country where water could be obtained from shallow wells, were loud in praise of windmill irrigation. This method seems to have reached higher utility, or come into more general use, near Garden City, Kansas, than almost any other place. Hence we visited that point and spent some time riding over the country and inves-

tigating a number of places where windmills were used for pumping water for irrigation.

The peculiar feature which in some form seems a necessity with this plan of irrigating, is the reservoir, already alluded to. These are constructed at as high a point as possible, by scraping up the soil into an embankment some three or four feet high and enclosing from a few square rods to half an acre or more. Then sufficient water is pumped in to wet the bottom and sides, and the whole is puddled by tramping with horses until the entire surface is reduced so fine as to close the pores in the soil and make it capable of retaining water. At the bottom of this reservoir, on one side, is provided an outlet to admit water into a ditch, from which it is distributed over the land in substantially the same way as heretofore described.

It may be remembered by some who were present at the meeting of this society at South Haven, that I was not very enthusiastic in speaking of windmills for irrigation; but in view of what they are actually doing in some portions of the west, there seems to be no denying that under certain conditions windmills are a success for this purpose. But certain facts should be kept in mind.

A good reservoir of suitable capacity might almost be called the keynote of success, and second only to an abundant supply of water for a good windmill and pump to draw from. Then we should not forget that the power required to raise water increases as the height increases; or, to illustrate, if one windmill will raise a certain quantity of water ten feet in any given time, it would require two mills to raise the same quantity twenty feet. Again, the power required increases as the quantity of water raised increases, or the power required decreases as the time allowed to raise a given quantity of water increases.

While such facts appear so nearly self-evident as hardly to need stating, yet, if we are not careful, some of them are occasionally overlooked. If, for instance, a man on low ground could get water by going ten feet below the surface, and should erect a windmill, and by the side of it a tank with staves ten feet high, might he not fail to realize, without a second thought, that it would require two mills to pump over into that tank the same amount of water that one mill would deliver at the surface of the ground? Or suppose a man has a well fifty feet deep, and another has one ten feet deep, and the nature of the soil and crops belonging to the former is such as to require irrigating twice as often as the latter, with the same amount of water each time, and each having the same amount of land. Would he be sure to realize at first, that if the latter required one windmill, the former would need ten mills; or that, while one could irrigate only one acre with one mill, the other could irrigate ten acres with the same mill?

It will be noticed that we speak of using several mills, instead of one larger mill, when more work is required, and generally we think that it will be found more satisfactory, as the first cost is but little, if any, more, and they are less likely to get out of repair and less expensive to put in order if they do need repairing; and besides, it enables one to start in with an inexpensive mill and then add others as necessity and experience seem to make desirable. It also often happens that a vien of water which is ample to supply a small mill and pump would not afford enough for a large one, although several small ones might be used near enough together to pump into the same reservoir.

But perhaps some may be asking, of what use has been all this talk about western methods of irrigation, and saying we have no places where it would be practicable to construct gravity ditches, and our soil, especially the sandy or gravely soil on which many of our orchards stand, is not suitable for constructing reservoirs? But let us see if this is so. Have not some of you soil containing clay enough to construct a reservoir, of such a nature that a few loads of clay hauled in would make it waterproof? Or do we know that a reservoir could not be profitably built of bricks and other materials, or that a wooden tank could not be used to advantage; and are we positive there are no places in this state where a gravity ditch could be made? On the contrary, we found a place where it could be done, on a small scale, on our own farm. With the aid of a common carpenter's level we discovered that a small spring-fed brook could, by conducting it through sewer-pipe, less than eighty rods, around the base of a hill or table-land, be flowed among several acres of lower land that is high enough, however, to suffer severely from drought. May there not be in some portions of the state inland lakes, not very far from some stream, and yet so high above the same, and where the topography of the country is such that a canal could be taken in a direction gradually converging toward said stream, and between which stream and canal there might be several entire farms, and a portion of several others, that could be irrigated? But this would require a survey to determine, and if there was nothing in the way, from the engineer's standpoint, there would still be the right of way to obtain and the need of some plan of combined effort, so that, for any or all these reasons, such a thing may be impracticable for the present. But who shall say that no such thing will ever be undertaken, perhaps in different portions of the state, when our people come to realize more fully the advantages and profit, if not in certain seasons the almost actual necessity, of irrigation?

It may be needless to say that we believe in irrigation, even for Michigan, and we have taken the first steps, at least, toward showing our faith by our works, although what we did last season was so late in getting into operation that but little practical result was obtained, it being the very last days of July before we were able to start our pump at all.

Having not less than sixty acres which in time we hope to get under irrigation, we have selected for the work a ten-horsepower engine and a four-inch centrifugal pump, the distance we have to raise water being about thirty-five to forty feet. Our supply was taken from the small stream already mentioned, but we found the quantity of water altogether insufficient, and could only pump a few hours at a time, and that by placing a dam across the stream, so as to accumulate enough to supply the pump.

The first piece we attempted to irrigate was set to young trees with strawberries and some potatoes between the rows of trees, all being well cutivated. With about two hours' pumping we had, probably, two acres with water between all the rows, which were five feet apart; and, as we saw the water glistening in the sunlight, and running over the sandy soil, which was so dry and hot that it had been a question whether water would flow over it at all, without being absorbed, we felt that a victory had been achieved, and the future of irrigation promised some practical good to the fruitgrowers of Michigan.

After stopping the pump we were a little surprised to discover that, apparently, the water had penetrated laterally only a very few inches, and we wondered if so much of it had gone directly downward that but little good could result. On the following day, however, the entire surface of the ground had a darker appearance, indicating that moisture had come to, or near, the surface; and, on pushing aside only thin portions of the soil, moist earth was found.

The next piece irrigated was a bearing peach orchard that needed cultivation. Here, as on the former piece of ground, we applied the water in furrows near the trees, and as before it seemed to go downward without wetting the ground laterally. But, unlike the former experiment, it did not come to the surface again, and so we gave the orchard another wetting by flooding the water over the entire surface so far as practicable, instead of confining it to furrows, and as the result of these two experiments it would seem that, for orchards at least, cultivation and irrigation should go together, the former being necessary to draw and gather moisture near the surface; and if cultivation is not practicable, then flooding the surface is better than applying water in furrows.

And now a few words as to results. It must be remembered that water was applied to the bearing orchard but a few weeks before time for gathering fruit, and it had not received proper cultivation; yet, on carefully sorting the fruit with a grading machine, a plain difference in the size of the peaches was shown, and on the irrigated piece of ground there could be clearly seen, within two weeks, an improvement in appearance of trees and plants. In fact, before watering, quite a number of the strawberry plants were dead or dying from drought, while, after watering, those not already too far gone took on an altogether better appearance, while the potatoes yielded double what anyone would have expected had water not been applied.

On the whole, our experiments are, so far as we can see, quite satisfactory thus far, and we intend to continue them another year if the season should be dry. Having already moved our engine and pump so we can draw water directly from the Kalamazoo river, we do not anticipate any further trouble from an insufficient supply; and, while we do not expect to show all the benefits of irrigation in one or two seasons, yet in time we may be able to demonstrate either our own folly in undertaking such a thing, or the folly of allowing orchards to suffer from dry weather in a state almost surrounded by water and abounding in streams and inland lakes.

Mr. Morrill: Is it practicable to drive four-inch tubular wells to a lower level, from a height, and pump in quantities to pay?

Mr. Williams: Yes, for fruit, but not for corn or other such crops.

Mr. Tracy: I have at times been in Kansas where they irrigate by use of pumps, many of them being very crude contrivances. They make large reservoirs, on elevated spots, from which they irrigate from five to ten acres of ground. I have heard men there speak of the great possibilities of irrigation in Michigan. Large quantities of water are necessary to the accomplishment of anything practical. But they have water in Kansas, Nebraska, and Colorado which is thick—you can not see into it. It flows

quietly along in ditches so slight that no self-respecting water would stay in them. This water, in the former two states, is within twenty feet of the surface, and so is very easily pumped up. I ask Dr. KEDZIE what virtue there is in the sediment of these waters of Kansas and Nebraska?

Dr. KEDZIE: They are strongly charged with alkaline and other mineral matter, very different from Michigan waters. The latter will be much harder to handle. There the sediment tends to fill the interstices of the soil and make the latter quickly impervious.

Mr. WILLIAMS: We were much surprised to find, upon our own farm in Saugatuck, how easily the water could be carried. It would go sixty rods in a furrow in light soil. We did not calculate how much we used per acre.

Mr. MORRILL: An inch of rainfall equals 1,000 barrels per acre. One may calculate from this how much water to use in cases of irrigation.

Mr. TRACY: Out there they think an inch in depth far too little, and provide for use of two or three inches each time.

Mr. KELLOGG: What measures do they use to prevent evaporation?

Mr. WILLIAMS: None.

Prof. TAFT: In California they used to do nothing to prevent evaporation, but they now use much less water at a time, and give thorough cultivation, getting a surface mulch of fine soil, and so retarding evaporation. In irrigation of gardens, the best way to apply the water is by means of tiles, laid one foot below the surface, if they are to be permanent, but in a simple furrow if otherwise. Two-inch tile will irrigate spaces from ten to fifteen feet wide in ordinary garden soil. In Texas they lay title direct in the trenches, by means of a machine which makes of them continuous pipes, making holes at certain distances through which the water escapes. This proves very successful among vegetables, but in case it were used among trees the roots would be very likely to penetrate the tile. Experiments of this kind, at the college, last summer, were highly successful.

Mr. J. C. INGLIS: Whenever we violate a law of nature, we suffer. Why not, instead of all this, advocate replacing the forests?

TILLAGE.

BY PROF. L. R. TAFT, AGRICULTURAL COLLEGE.

The original meaning of the word "till" is, to aim at excellence, and we may define tillage to be handling of the soil in such a way as will be likely to produce the maximum results. It will then include all such operations as plowing, sub-soiling harrowing, and the cultivation the crops receive.

Taking these up in detail, we may say that plowing is of value mechanically, as it loosens up the soil and allows the roots to enter and pass through it in search of food. It facilitates the entrance of air to aid in the solution of the plant food, and of water which dissolves the food thus made soluble. It also increases the reservoir capacity of the soil, enabling the plants to better withstand drought. Plowing also, by breaking and turning up the soil, exposes its particles to the action of the air and water, and of the ferments which induce various chemical changes.

Sub-soiling, which stirs up the soil to the depth of sixteen to twenty inches, by means of a so-called subsoil plow, after each furrow has been turned with a moldboard plow, is of value upon land where there is a stiff hardpan within a foot or so of the surface, particularly for the pear and plum. Very few of the other fruits should be placed upon land that needs sub-soiling. It not only opens up the land and offers new feeding grounds to the roots, but it increases the reservoir capacity of the soil. While this is of advantage in dry seasons, it often proves injurious in seasons when there is an excess of water in the soil.

Especially for garden crops, too great care can not be taken to give the land a thorough dragging after it has been plowed, as it breaks up the clods, closes up the holes in the soil, thus preventing its drying out, and brings it into such a condition as will favor the capillary power of the soil and the ready germination of the seed.

The cultivation that is given the crop itself will not only open it to the entrance of air and water, but it is of even greater importance in forming a soil mulch, by which evaporation of the water is prevented.

Not only is water required as a part of the food of plants, since it makes up from seventy-five to eighty per cent. of their weight, but it is also necessary to dissolve the plant food that is obtained from the soil, which can only be taken in by the plants as a solution.

The rainfall of most parts of the country is from thirty to forty inches annually, but of this amount nearly one half falls in the winter months when the ground is frozen and a large part of it runs off into the streams. During the heavy showers of summer a large amount is also lost in the same manner. We must add to the amount that never enters the soil about twenty per cent. which percolates downward through the soil and so is lost to the crops. We thus find that the amount that is really at the service of the plants is never more than fifteen or twenty inches.

It is reckoned that many crops, such as corn, take from the soil during the season about thirty-five times their own weight of water, or, as it is sometimes expressed, three hundred times the weight of the dry matter

they contain. If for any reason this amount is not available, the crop will be cut short. It is said that, even in the so-called moist climate of England, a year seldom passes when the crops would not at some time during their growth be benefited by more moisture. From this can be seen the necessity of securing for the crops as much as possible of the water that falls.

Among other sources of loss is the evaporation that takes place from the surface. It has been found that this can be lessened if a mulch of some kind can be provided for the surface. While straw, marsh hay, or any similar waste materials are of value for holding the water, they have the disadvantage of drawing the roots to the surface, and as a result the plants are likely to be injured in a cold winter. On the other hand, a mulch composed of loose soil answers just as well to hold the water, while the roots remain in the moist soil at some distance below the surface. The soil mulch can be maintained throughout the season if the surface of the soil is stirred to the depth of two inches at intervals during the summer.

With many farmers the main idea in cultivating is to kill the weeds, but although this should be considered it should not be the prime object. Weeds are commonly understood to be plants out of place, or those for which no use has been discovered. From whichever standpoint they are considered, farmers have for a long time understood that a failure might be expected if they were allowed to grow. The real nature of the injury that weeds cause has until recently not been well understood, and even now the tillage that is given by most persons, instead of being based upon rational grounds, is intended only to keep down the weeds. The old idea that the principal injury from weeds was in shading and crowding the other plants, thus depriving them of air and light and robbing them of some of the food that would otherwise be available, is correct only in part. Added to this, and of even greater injury, they take up large quantities of water and thus deprive the crop of the means of securing the plant food that may be available. The grain farmer also suffers from the injury resulting from the presence of foul seed in his soil, while the man who neglects the proper cultivation of his hill and drill crops, and allows the weeds to grow, will find that he has another evil to contend against, due to the rapid evaporation of the water from the soil.

If one is to till his soil merely for the purpose of killing weeds and preventing the loss that will result if they are allowed to grow, the work should certainly be done before they have reached any size. Just after they have germinated, as they are pushing their way out through the soil, the weeds are very delicate, and the least disturbance of the surface will be sufficient to destroy them, while, if left for a few days and allowed to become established, they can only be subdued by several deep workings of the soil, and even then some of them that have obtained a firm hold in the soil may not be destroyed.

Even if the soil is entirely free from weeds, frequent tillage should be the rule. If the surface soil is frequently stirred, so that it is kept light and open, the evaporation of water will be greatly decreased. After a rain the general course of the water in the soil is downward, impelled both by gravity and capillary attraction. As soon as the rain ceases and evaporation from the surface begins, an upward movement commences, the water passing from a moist particle to the drier one above, that has given off part of its moisture. This is due to the adhesion of the water to the soil particles and the tendency to establish an equilibrium. When the soil has

been puddled by rains it is closely packed together, and the sides of the soil particles are in close contact. To a certain extent this is desirable in the under soil, as it aids the capillary action of the particles in bringing the water up from below, toward the surface where it will be available for the plants.

To be of value to the plants, however, it must be held there and prevented from evaporating. It is in part because the stirring of the surface loosens it, and, by increasing the size of the spaces between the particles of the soil, lessens the rapidity with which capillary attraction can lift the water to the very surface, that cultivation has such a wonderful effect upon the growth of plants.

It is a well-known fact that evaporation is most rapid, and the most water is given off, from a clay soil where the surface has been allowed to bake, that is, the rains have puddled it and brought the surfaces of the particles very closely together, so that, as capillary attraction is very rapid, the water is carried to the surface and evaporated faster than it can be brought up from below. Even if a sandy loam soil is untilled, the amount of water given off is one half greater than from another of a similar nature, where the surface of the soil is kept loose. The portion of the soil that is loosened may be the drier for it, and for this reason a soil that is too wet may be aided in giving off its surplus water by deep tillage; but in a properly drained soil it is better to allow the water to sink down to the level of the ground water, than to aid in throwing it off into the air where it will be lost to the crop.

Besides the injury that will be done by deep tillage, in cutting off the roots of plants, the water that is given off from the stirred soil would prove of considerable benefit to the crop in a dry season. Aside from its value in destroying weeds and preventing the evaporation from the surface, cultivation, by keeping the soil loose and preventing a crust from forming, aids in creating and developing plant food in the soil.

To be effective the cultivation should be given often enough to keep the surface from baking, in the case of clay, and from settling down and becoming compact in the case of sand soils. At any rate, all soils should be stirred after every rain, so soon as the ground has dried sufficiently to work.

For garden crops it is well to have some tool that can be run over the surface a few days after the seed is sown and before the plants are up. This will not only break the crust and prevent evaporation, but it will destroy the young weeds and save hand weeding. A little later it should be done again. The common steel rake was formerly used for this purpose, but we have found the Improved Breed weeder to do about as good work, and it covers a strip eight feet wide. If it is started before a crust forms, and is used once per week, it will keep the ground in perfect condition without injury to the plants. For orchards, after they have been brought into good condition in the spring, they do good work. For heavy soils, especially if they have been allowed to bake, some of the smoothing harrows may be preferable, but after the first dragging in the spring it is best to keep the deep-working tools out of the orchard.

The effect of frequent shallow cultivation is not only to enable the trees to make a good growth and perfect their crop, but it will generally insure the development of fruit buds for the next years' crop, while on the other hand the trees, without cultivation, are in a weak condition and the crop of fruit will be small and imperfect.

It is claimed by some persons that cultivation late in the season causes a late growth, and that the trees are likely to be winter-killed, but this seldom results if the cultivation has been continuous. When, from press of work or other cause, no cultivation is given during the month of July, the trees suffer from lack of water, growth stops, and the wood and buds ripen up for winter If, after this has taken place, the soil is again stirred, a second growth is likely to occur and winter-killing will be almost certain to follow.

The operation of rolling is thought by some to be of benefit by preventing the evaporation of water from the surface, but if anything it has the opposite effect. Upon light soils, rolling is of value to increase the capillary passage of the water from the under soil into the portion that was turned by the plow, by bringing the particles closer in contact. This will increase the amount that is available to the plants, and for increasing the amount of water in the very surface soil it is of special value to aid the germination of seeds. The opposite effect is often seen when a soil that is quite dry is plowed for some crop in the midst of a drouth. The capillary movement is greatly hindered and the surface soil will become so dry that the seeds will germinate very slowly, if at all, while, had the land been rolled; or, in the case of wheat, drilled in without plowing, more water would have been available and a better germination would have been secured.

While the nature of the operation required in the fitting of the land and its care will vary according to the soil and crop, every one should have a knowledge of the requirements of each, and of the effect upon the movements of the water in the soil, of the various methods of treating the land, and then should take such steps as will secure and retain for the crop the desired amount of water.

Mr. Gould: How about late cultivation of the peach?

Prof. Taft: Much depends upon the age of the trees and condition of the soil. Young trees should not be cultivated much later than August. Bearing trees may be cultivated on till the middle of September; but after stopping, do not begin again. Raspberries should be cultivated continuously during the bearing season, but strawberries, of course, should not be so treated. The surface soil, by cultivation, becomes dry, but it makes a perfect mulch, and so it should be stirred every week or ten days. Rolling helps make the surface moist, but should not be practiced in the orchard. Rolling helps in the germination of small seeds, when sown in dry soil, but even then the surface should be stirred, when possible, so soon as germination has occurred. If your soil is heavy and wet, stir deeply at first, and till the roots take possession, then shallower. Rolling is also sometimes desirable in order to break up lumps, but then stir at once to pulverize the surface.

Prof. Tracy: I have to examine thousands of acres each season, and have sometimes thought that more harm than good is done by the ordinary cultivator. I have in mind a case in which a hired man cultivated a

field of beans growing for seed. In the forenoon he used the cultivator as his employer had set it for him, the front teeth cutting the deeper and turning furrows toward the plants; but in the afternoon, thinking he knew more than the employer, he changed the cultivator so that the side teeth cut the deeper, cutting off roots and turning the earth away from the plants. The difference was manifest when I saw the field some time later; but, until discovery of the change of the cultivator, the owner could not understand what had caused it. The yield was $1\frac{3}{4}$ bushels per acre more on the portion which had been properly cultivated in the forenoon. In preparing soil for crops, it is best to cultivate, then plow, then cultivate again. Whatever deep cultivation is done should be when the roots are yet short, so that they may not be cut off. Yet what Prof. TAFT has said about frequent cultivation is true, because but a shallow stirring of the soil is intended. The old-style shovel and double-shovel plows are doing more damage in this country than any Democratic administration ever did! [Laughter.]

TRANSPORTATION OF FRUITS.

BY MR. J. A. PEARCE OF GRAND RAPIDS.

This question, the transportation of our fruits, is of so much magnitude that it may well merit our earnest consideration. The great mass of our growers have never given this subject more than a passing thought. They do not realize how much there is in it, nor how much the success of their business depends on it. Before I proceed, let me give you a few figures. Our peach crop in the vicinity of Grand Rapids was estimated at 300,000 bushels. When the season was over it was conceded that it had gone above the estimate. A saving of ten cents per bushel on that amount to the growers, is $30,000. If we estimate five cents per bushel saved by the half rate, on covered baskets, which we got the railways to make, we find that it is a saving to our growers of $15,000, and I am sure it went far above that. On the last car of peaches we shipped, the half-rate amounted to $44. This half-rate is taken off from Buffalo to the Mississippi and from the Ohio to the north. So you can make your own estimate as to the amount of saving it is to the growers living in that vast region. This just concession was gotten from the transportation companies through the combined efforts of the kindred fruit associations of the Grand River valley.

This is only one small item of the benefits that have come to the growers through these organizations, and yet some of the growers turn over their dollars and hesitate and wonder if they are going to receive the worth of their money.

It is to organization that I look with hope for any further improvement that will come to the transportation of our fruits. There should be a closer communion between the fruitgrowers and the transportation companies. They should be made to feel they are a part of our business, and a very important part, too. They must be made to realize that if we go on and enlarge our fruit plantations, they must keep pace with us, in giving us improved facilities for getting our fruit to the consumer cheaply, quickly, and in good condition. In the past some of the railway officials have been invited to our fruit meetings. This I think should be encouraged more in the future, that there may be a better understanding on the part of the officials as to the needs of the growers, and also that the growers may more fully understand what was possible for the transportation companies to give them.

I take little stock in this monopoly cry, indulged in, in some agricultural quarters, against railways. They are undoubtedly in their business to make money, but, so far as I have had dealings with the managers personally, I have found them accommodating, broad, brainy men, who were sagacious enough to see that it would be to their advantage to help build up a business rather than to destroy it. I therefore think if we will go to them in a business-like way, through our organizations, and tell them what we need, they will try to meet us half way.

One of the first requisites in securing good facilities is to raise plenty of fruit, so there will be a business of importance enough to enlist the attention of the transportation companies. Without this we can not expect much improvement. One locality can not well make arrangements that will answer the purpose of another; each will have to work out a system best suited to its own needs. But whenever the conditions are such that what is known as the granger system can be used, it will be found to be one of the very best, as that on the Illinois Central, where the berry-growers load their own freight, and as soon as it is done the train pulls out with all possible speed to Chicago to be in time for the morning market. Without such an arrangement you can readily see how impossible it would be for the people to raise and market so vast an amount of such tender fruit in presentable condition. A man is kept in Chicago to see to the proper unloading and forwarding to the commission houses. By this system, it has been stated, the rate of freight from Cobden, Illinois, was reduced from $2.50 to 22 cents—a valuable saving, I assure you.

Something of this plan has been in successful operation on the West Michigan from the peach belt to Chicago. I had hoped that a train might have been started from Grand Rapids, instead of Holland, as now. I believe it would give us quick connection with the west, a system which would be desirable for us and that I think we should work to bring about. Inasmuch as our fruit goes out to so many different points from Grand Rapids, there should be a night train going out over the different roads to important points that might be reached by the morning—say the Saginaw valley, Detroit, Toledo, Fort Wayne, Milwaukee by car and boat, and many other points that could be well reached. Have these trains held as late as possible and make their runs, so that the fruit can be brought in from the orchards and started on its way and reach these places of destination in as fresh state as it now is put on the Grand Rapids market, when it stands in our barns over night on the wagon. Then these points could receive the fruit in so fresh a state it could be distributed from them in as

good condition as it now is from Grand Rapids, thus greatly widening our market. If our fruit production continues to increase as fast as it has of late, some such system will have to be adopted.

There are many other things that are very imperfect in our shipping arrangements, that need our attention, but we have not time to mention all in this paper—such as the way our fruit is trucked through the freight houses, and the poor arrangement of our ventilated cars, so-called. All these things need our attention, knowing that one careless handling along the line may greatly lessen the value of a package of fruit to the owner and its usefulness to the consumer.

In conclusion, let me ask that we work together to bring about these desirable methods in the transportation of our fruit, as they are not likely to come of themselves.

Mr. R. D. Graham: We do not send much fruit from Grand Rapids to either Chicago or Milwaukee, but mainly to Cincinnati, St. Louis, and other parts of the south and the southwest. Nine tenths of what we ship go in open bushel baskets placed on shelves in refrigerator cars. This arrangement has proved very satisfactory in all respects, and making the shelves costs less than covers for the number of baskets the cars contain. Much of my fruit went direct to the cars from the trees, and so handled but once, a point of much value. Packing fancy fruit in fancy baskets may pay, but only a few of us grow such fruit. When fruitgrowing becomes more our business, the less trouble we will have about packages. We have done ourselves much good, within the past year or two, though paying attention only to packages and shipment rates. The cars are packed full, so there can be no shifting about of baskets, and we have had no trouble from meddling with fruit at point of delivery. My fruit went from the orchard in ripe condition, and reached the consumer in the best possible order. I got $1.35 net, one time, for two cars, sold in Grand Rapids. I used neither tarletan nor any other covering.

Mr. Mack said he believed the Detroit commission merchants would co-operate with the Grand Rapids growers to secure night trains.

Mr. Munson: The Grand Rapids and Indiana people said it would have paid to run special fruit trains north as well as south.

Mr. Kellogg: When all the trees in Ionia and Kent counties get into full bearing, you will see trains loaded for Cincinnati, St. Louis, Louisville, and other points. We can not overdo the business of growing peaches.

HORTICULTURE AT LOWELL.

BY MR. N. P. HUSTED OF LOWELL.

Horticulture in Lowell, as a branch of commercial industry, dates back about twenty years. It has progressed from a very primitive beginning until it is now recognized as a leading and profitable industry. The experience of our orchardists within the past few years has fully established the fact that the soil in the vicinity of Lowell affords superior advantages for growing fruit. Tillers of the soil who are complaining of dull times and the very low price of farm produce should bear in mind the fact that fruit has always found a ready market, selling at a highly remunerative price. The present demand for choice fruit is far in excess of the supply. The consumption of fruit is rapidly on the increase, and in a greater ratio than the production. In addition to our large home markets, a foreign demand is springing up for the products of our orchards, which will absorb our surplus for years to come. The processes of canning, drying, and preserving fruit, within the past few years, have made rapid strides. The facilities for rapid and cheap transportation have been greatly increased, demanding greater supplies, and the planting of more and larger orchards. The products of our orchards are needed to feed the millions of consumers. The outlook for fruitgrowers was never more encouraging than at present. The experience of practical orchardists has fully established the fact that the net proceeds of an orchard on good fruit land, in full bearing, is many times greater than the same land can be made to produce if planted to ordinary farm crops. There are thousands of acres of the choicest fruit lands surrounding Lowell, which, if set to orchards, would soon return large net incomes for their owners with comparatively little labor.

It is a fact that the price of many farm crops has fallen below the cost of production. In 1863, wheat was worth from $2 to $3 per bushel, wool $1, horses from $100 to $250 each. In 1894, wheat is selling for 45 to 55c per bushel; good horses are bringing from $10 to $50 each, and wool sold from 10 to 15 cents per pound. Times have been dull, and money scarce, but notwithstanding the depressed condition of trade, and the money panic, fruit has sold at good prices, netting the growers large profits.

For the purpose of showing the extent and condition of fruitgrowing in this section, the Lowell district horticultural society appointed committees for several townships adjoining Lowell. Their reports show large acreage of orchards; a great interest in horticulture; the business on a sound basis; the net returns satisfactory, and all interests pertaining to fruit culture in a profitable, progressive and prosperous condition. Lands are being fitted for the planting of trees coming season on a more extensive scale than ever before.

Township of Boston.—22,000 apple trees, 2,000 pear, 1,000 plum, 133,000 peach. Commenced setting trees for commercial orchards twenty years ago. Have had full crops of peaches for the years 1891, '92, 93 and '94. Sold 22,000 bushels of peaches in 1894 at an average price of $1 per

bushel net, $22,000. Has ten acres of strawberries, eleven of raspberries, three of quinces.

Vergennes.—10,000 apple trees, 300 pear, 900 plum, 26,000 peach. Estimate of peaches sold in 1894, 6,000 bushels, $6,000.

East Half of Cascade—2,800 apple trees, 2,400 pear, 3,600 plum, 22,000 peach, 15 acres of strawberries, 63 of raspberries. First peach orchard set by Dr. WOODWORTH in 1864. Peaches sold in 1894, $4,500.

Keene.—4,500 apple trees, 1,900 pear, 1,000 plum, 105,000 peach. 19,000 bushels peaches sold in 1894, $19,000. In the Hesler neighborhood in Grattan, 15,000 peach trees. Sold in 1894, 7,000 bushels, $7,000.

School District No. 6, Lowell.—5,000 apple trees, 1,000 pear, 700 plum, 29,283 peach. Peaches sold in 1894, 6,543 bushels $6,543.

Lowell Township, including above.—19,000 apple trees, 2,000 pear, 3,900 plum, 107,000 peach. 21,000 bushels sold in 1894, $21,000.

Total of peaches sold in above sections for the year 1894, 79,500 bushels, $79,500.

For the purpose of showing the profits of peach lands, under a thorough and systematic system of cultivation, we will give the results of a few orchards.

E. E. CHURCH has an orchard of 500 peach trees; location, seven miles southeast of Lowell; soil, elevated clay loam; timber, white oak and hickory; well fertilized at the time of setting, with barn-yard manure. Trees set out six years and given thorough cultivation; cropped the first two years with corn, the third with buckwheat, the returns from the crops more than paying the expense of setting out the trees and cultivation. Received from the fruit sold: 4th year, net,.$400; 5th year net, $500; 6th year, net, $600. Total for three years $1,500. The trees are set one rod apart each way and occupy about 3½ acres. The above shows a net profit of over $140 per acre each year since the orchard commenced bearing.

FRANK WHITE, from 2½ acres of peach orchard, realized $462.75; orchard on Peck's hill, in corporation of the village of Lowell.

J. E. LEE has an orchard 1½ miles northwest of Lowell, 700 trees set 12 years, from which he sold in 1891, 830 bushels; 1892, 985 bushels; 1893, 1,335 bushels; 1894, 1,230 bushels, a total of 4,410 bushels at $1.15 per bushel net, $5,071. The trees cover 7½ acres. A net profit of $169 per acre yearly for the first four years. Mr. Lee has pursued a thorough and systematic course of cultivation, pruning, thinning, sorting, and grading his fruit, fertilizing annually.

MATTHEW HUNTER has a peach orchard of 910 trees, set in the spring of 1888 and '89, from which he sold in 1892, 929 bushels, $1,161.25; '93, 750 bushels, $750; '94, 921 bushels, $1,151.25, a total of $3,062.50. The orchard covers about six acres; cultivation thorough; not fertilized; orchard is in the southeast part of Lowell township, five miles from the village.

Totals for the number of fruit trees in the Lowell district: Boston, 133,000 peach, 22,000 apple, 2,000 pear, 1,000 plum.

Vergennes, 26,000 peach, 1,000 apple, 300 pear, 900 plum.

East half Cascade, 22,000 peach, 2,800 apple, 2,400 pear, 3,600 plum.

Keene, 105,000 peach; 4, 500 apple, 1,900 pear, 1,000 plum.

Lowell 107,000 peach, 19,000 apple, 2,000 pear, 3,900 plum.

Totals, 404,000 peach, 49,300 apple, 8,600 pear, 10,400 plum.

Evaporators.—Eighteen evaporators were in operation in the year 1894. Amount of apples used, 159,000 bushels, at an average price of 25c per

bushel, $39,750 paid to farmers and fruitgrowers. Amount of evaporated fruit, 6½ pounds to the bushel, 1,033,500 pounds sold at 6c per pound, $62,010; chops sold, 5,000; total, $67,010. 11,000 barrels of apples sold, $1.25 per barrel, $13,750. To this add $39,750, paid for evaporating, and we have, paid to the growers for their apple product for 1894, $53,500.

Total received by the growers for apples and peaches for 1894: peaches, $79,500; apples, $53,500; total, $133,000.

This could largely be increased by addition for sales of pears, plums, quinces, raspberries, cider apples, etc., but, having no means of ascertaining the amounts sold, we do not include them in the report. Yet only 15 per cent. of available fruit lands are occupied.

In conclusion we will say to all interested in horticulture, your harvest has been abundant and your profits great. Onward should be your watchword. Go forward in the work; properly cultivate, fertilize, and care for your orchards, and great shall be your reward.

Mr. RICE: In New Jersey, it is said, two or three good crops of peaches are all that can be expected of a tree. I am glad to know we are so far ahead of them in Michigan.

Mr. HUSTED: Time was when our trees would live and bear longer than they do now—when the country was new. But now the soil is much exhausted, and we do not think of trying to grow orchards without commercial fertilizers.

Mr. LYON of Lowell knew of a seedling peach tree in the vicinity, which had borne for forty years, and bore the past season.

Mr. HUSTED: In some places in this vicinity, growers have lost a crop only once or twice in twelve years. Others have never missed one. The best locations are loam soils 150 to 200 feet above Grand river. I prefer a soil as heavy as I can get and yet be well drained.

Mr. WESLEY JOHNSON of Lowell: Mr. J. E. LEE'S orchard has not wholly failed in fourteen years. It is on oak openings soil, clay loam, well drained naturally.

Mr. EARL JOHNSON: I have a small orchard, four years old. At one time last winter the mercury went to 14 degrees below zero, and in the morning it grew warmer, and thawed a little during the day, and yet I had a good crop last fall.

Mr. A. HAMILTON: I do not think it would be well for Lowell people to encourage mercury to go much lower than 14 degrees below zero. (Laughter.)

POINTERS ON GRAPES.

BY MR. W. K. MUNSON OF GRAND RAPIDS.

In discussion of the subject assigned me, "Pointers on grapes," I shall go so little into details that much of what I say would apply to the culture of other fruit fully as much as to grapes.

In order to grow grapes profitably, one must have the proper tastes and qualifications. I have heard men say they would rather take off their coats and split rails than to "putter around with grapes." Such men would better stick to splitting rails, as they would be more sure of making a living than in raising grapes. The right man for the place is one who can see beauty in a well-loaded vineyard, besides the dollars and cents; one who would delight to go through the vineyard as the fruit ripens, and when he sees a large, well-formed bunch of grapes, pat it on the cheek and say, "That's a fine cluster." Then he wonders what should make that bunch better than its mates, and tries to find the reason.

Grapes will adapt themselves to a great variety of soils, provided there is good air and water drainage.

The varieties should be such as are adapted to the climate and soil, and to the market which is to be supplied. The object in pruning is (1) to confine the strength of the vine to producing a limited number of bunches without materially diminishing the number of pounds produced per vine, thus securing larger berries and bunches, of better quality; (2) to so control the growth of the vine that it will be in convenient shape on the trellis, for cultivation and picking, and to properly distribute the fruit so it will get the full benefit of the sun and air. Care should be taken to leave a spur near the main cane, with a bud in a good position to produce a new cane to renew with next year.

POINTERS.

1. A proper man for the business.
2. A good location.
3. Suitable varieties.

In order that the vines may do their best, they should be made perfectly happy and comfortable, (1) by giving them a nice, clean place to live in; (2) all they can eat of suitable food; (3) kept free of insects and fungi by spraying with the right mixtures; (4) some system of annual close pruning; (5) frequent shallow cultivation during the entire growing season; (6) a certain amount of good business tact, with strict honesty in picking, packing, and disposing of the crop.

Asked what varieties he preferred, Mr. MUNSON gave the number of vines of the several kinds he has in his vineyards: 1,600 Concord, 2,600 Worden, 1,600 Niagara, 1,000 Brighton, 600 Moore, 600 Delaware.

Mr. WHITMIRE: Will it pay, at present prices, to set grapes?

Mr. MUNSON: Well, I make a living at it. My grapes pay me an average of $100 per acre.

Mr. WHITMIRE: Yes, but will it now pay to set new vineyards?

Mr. MUNSON: I can only say that I keep making new settings. Worden pays best, Niagara next; Moore is not very desirable. There is no profit in keeping grapes longer than one month; there is too much waste, and when grapes come in from New York prices are cut so that there is no profit. Concord is about like Worden in point of profit. In supplying a market through the season, it is desirable to have these several varieties. As to fertilizers, I use stable manure at first, while the young vines are growing, with bone meal and ashes later, when the bearing age arrives. I am now spreading 200 bushels of ashes per acre. I do not lay down my vines. Bone and ashes produce higher color and better and larger bunches, of finer quality, than any other fertilizers of which I know, and they cause the fruit to stay on the stems better. My soil is a strong clay loam. Corn and potatoes are grown among the vines the first year. I put vines on their trellises as soon as possible (upon the first wire the second year) in order to get straight and strong vines which will in part support themselves. I fasten them up strongly at first, to help in the latter result. I leave but thirty to forty buds for the new crop. Many growers seem to forget that all the fruit grows within eighteen inches of of the buds, no matter if the vine goes on ten feet further I practice very little summer pruning, only taking off the suckers. My vineyard is already pruned for next season's crop; but pruning may be done any time after the leaves fall. It must be completed before the sap starts in the spring. I know of good grapes on land too light for general farming, but on such soils they require more feeding.

Mr. H. H. HAYES: Moore does not bear well. I have an acre of this variety, but it does not yield a ton per year.

Mr. PEARCE said he knew of a man whose fence about his peach orchard is a trellis of grapes, and on one occasion the trees saved the grapes from frost.

Mr. MUNSON said his line fences are grape trellises, and they pay at the rate of one dollar per rod, instead of being an expense, like other fences.

MANURE IN HORTICULTURE.

BY PROF. R. C. KEDZIE, AGRICULTURAL COLLEGE.

Twelve years ago I read a paper before this society, on "Manures in Horticulture," but he is an egotist who imagines the public will remember what he said a dozen years ago. You will pardon me if I repeat some of the things I then said. It is not a matter of first importance to say something new, but rather to say what is true.

Different classes of animals require different kinds of food: the dog will thrive on meat, but starve on grass; while the ox would go hungry on the best beefsteak, but grow fat on hay and corn. In like manner it was once supposed that plants, with their widely varying qualities, needed correspondingly different kinds of manure; but it is found that plants grown either on farm or in garden have practically a very uniform composition and require the same natural elements.

The Agricultural Thirteen.—Only thirteen elementary substances are found in crops, and this baker's dozen make up the innumerable forms of plant life. These elements come from air and soil through the ministry of water. Carbon makes up one half of all vegetable substances, but it comes to the plant from the atmosphere in the form of carbonic acid, and it is literally as free as air. We need give it no thought in our scheme of manures. Oxygen and hydrogen are furnished to the plant in the form of water, which comes from the air in its journey by the sky-route from ocean to ocean, and is only stored for the time in the soil. But water is a prime physical condition of plant life. If the benediction of the sky is withheld, in vain the efforts of the husbandman. A rainless land is a dusty desert, no matter how rich in manurial elements; and almost any land can be made productive if plenty of water is furnished. Dr. Sturtevant published a very striking lecture, "Water the Universal Manure." You all recognize the importance of water in horticulture, and that, with abundant and well-distributed rain, successful crops are sure, while the dreaded drouth is death to the hopes of the fruitgrower.

Sodium and chlorine, in form of common salt, are found in quantity sufficient for most plants, in all the soil-waters of the state. Silica and oxide of iron are found in ample supply in all our soils. Sulphate of lime furnishes the plant with the required amount of sulphur, and lime and magnesia are found in most soils in sufficient supply for the ash of plants. This accounts for ten of the thirteen chemicals of agriculture, all abundantly supplied to the plant by the liberal hand of nature to all Michigan soils, or easily supplied by two cheap and abundant manures, viz.: salt and plaster.

In this discussion I confine myself to the direct needs of the plant for growth, and do not consider the indirect influence of some of these substances by inducing changes in the inert materials of the soil, such as the effects produced by lime, plaster, salt, and the vegetable matter or humus of soils.

The Tripod of Agriculture.—The preceding discussion has shown that ten of the thirteen chemicals of agriculture are either supplied in exhaust-

less profusion or so readily obtainable that the tillers of the soil need feel no anxiety. The case is different with the other three, the most precious, costly, and indispensable substances, without which no form of life, vegetable or animal, is possible—the tripod of agriculture and the basis of life—potassium, phosphorus, and nitrogen; a silvery metal, a waxy solid, and a gas.

It is not in these separate forms that these materials are found in plants, but in states of chemical combination they are found in all plants, and in the absence of any one of these no form of life could exist. They are not only the tripod of agriculture, but the tripod of life. They exist in only small quantities in soils, are soonest exhausted by injudicious cropping, and are the most costly to replace. In the majority of cases a soil is exhausted by cropping by the removal of one or more of these materials below the requirements for a full crop. Not only is each one of these three indispensable for plant life, but a limited supply of any one will correspondingly limit the action of all other manurial materials in the soil. To accumulate in the soil and to present to the plant in active form these three substances, are the essential chemical conditions of extraordinary cropping. With abundant supply of these in soils of ordinary composition and physical condition, there are no limits to production save those imposed by physical conditions of growth—the sunshine and the rain.

Manure.—Manure is any substance added to the soil to increase the growth of plants by furnishing increased amounts of plant food. The best example is barnyard or stable manure. Animal excrements have been recognized from earliest times as powerfully promoting plant growth. "Dig about and dung it" was the biblical prescription for an unfruitful tree. Stable manure is a complete manure, as it furnishes all the materials for plant growth in an available form.

I need not talk to you about the value of stable manure. The only trouble is, how to get enough of it. The fruitgrower does not keep enough stock to furnish the desired amount. I will, however, speak of two points about stable manure.

(1.) The quality of the manure depends largely upon the kind of food fed to the stock. President Wells told me of a farmer near Constantine who fed a large amount of stock for the shambles, especially sheep, buying grains and concentrated foods to fatten the stock. In a few years his farm became too rich to raise grain, and he had to give away his stable manure for a time. Not many farmers are troubled in this way; but the hint, how to intensify your manure by feeding coarse grains and bran, is worth remembering.

(2.) The value of stable manure depends upon the way it is kept. Exposure to rain greatly lowers its value, especially when the drip of the eaves washes the dung heap.

Some experiments on this subject have been carried on at the college this year. Three boxes, lined with tin, and with tubes to carry any washwater from rain into jugs, for analysis, were filled with 400 pounds of stable manure, of the same quality, on June 29. The boxes were three by four feet, eighteen inches deep. After filling and weighing, one was placed where the drip from the eaves of a twenty by thirty foot barn would fall upon the contents of the box; the second box was placed in the open yard, where it would receive the natural rainfall, and the third box was placed under shelter. The drainage from the two exposed boxes was

gathered after each rain and analyzed. The contents of the three boxes were weighed and analyzed, and the results of the three kinds of exposure are given in the following table: The results of simply keeping the manure, or conversion of "long" into "short" manure are exhibited in the changes in the contents of the box under shelter.

Results of weathering stable manure for five months, June 29 to November 23, 1894.

Original manure.	Pounds. Ammonia.	Pounds. Phosphoric acid.	Pounds. Potash.	Losses by weathering.	Pounds. Dry substance.	Pounds. Ammonia.	Pounds. Phosphoric acid.	Pounds. Potash.
June 29 (69 lbs. dry material)	2.52	1.33	1.63	Manure in open yard	32.	.86	.71	.72
Manure in open yard	1.66	.62	.91	Manure under eaves	33.	1.07	.76	1.37
Manure under eaves	1.45	.57	.26	Manure under shelter	27.	* .11	.00	.00
Manure under shelter	2.63	1.33	1.63					

* Gain.

Conceding the great value of stable manure, we must yet face the fact that the supply falls short of the demand, and the fruitgrower must look for materials from other quarters to make up the deficiency. The cheapest and best supply for the mineral elements of manures, for vegetable growth, is wood ashes, which furnish potash, lime, magnesia, and phosphate, and in the proportions in which they existed in the leading component plants, woody fibre. No words can express too strongly the value of wood ashes to the fruitgrower. Potash and phosphates are especially concerned in causing vigorous and healthy growth, since the ash of feeble and stunted plants is deficient in potash and phosphoric acid, while strong plants have a large amount of phosphate of potash. These chemicals make firm, hard wood, short joints, and early ripening of twigs in autumn, while excess of nitrogenous materials causes a sappy growth, and leaves the terminal buds in autumn soft and immature, fit for winter-killing. Wood ashes in the proper proportion aid in the formation of trees of good constitution and hardy growth. They may not prevent yellows and fire-blight, but they place the trees in the best condition for resisting these insidious diseases. Leached ashes differ mainly in the loss of a good part of the potash contained in fresh ashes, but they are of great and permanent value for the orchard. Coal ashes have very little value as manure.

If ashes are not available for supply of potash, we must turn to commercial salts, such as the German potash salts. Here are specimens—the sulphate and the muriate of potash. These contain from 40 to 45 per cent. of real potash. The sulphate is preferred to the muriate. These salts can be applied in doses from 200 to 400 pounds per acre, when potash is needed. These salts are very soluble and liable to be washed away in drainage water. It is best to apply them when the plant is taking on active growth in the spring, so as to be appropriated by the plant.

For an extra supply of phosphate we use bones, broken and divided or ground into bone meal, powdered phosphate rock from South Carolina or Florida, or the various superphosphates in the form of commercial fertilizers, of which many excellent kinds are now in the market. The law of 1885, requiring an analysis and license for their sale, has driven some

worthless fertilizers out of the market, saving many thousands of dollars to Michigan farmers and horticulturists, and has brought most of the remainder to a high standard. Do not buy an unlicensed fertilizer unless you wish to be cheated.

I do not know that the time has come in this state when the general farmer can profitably expend much money for commercial fertilizers, but I am of the opinion that the fruitgrower and truck farmer can often secure good profit by their use.

Phosphates tend to restrain the formation of leaf and fibre, and promote the formation of flower and fruit. Many years ago, H. G. Reynolds had a pear orchard on his farm at Old Mission, which made a heavy growth of wood but did not form fruit buds. Year after year he sought fruit but found only leaves. He asked my advice and I told him to give the soil a good dose of superphosphate alone. He made the application, but soon after sold the place, and I never heard the result of the experiment.

The tendency also of superphosphates to hasten the maturity of crops is worth considering. In many cases it is the early crop that gives the profit, especially of perishable products. The early strawberries, potatoes, tomatoes, and grapes command the extra price. True, the railways often cut the ground from under the gardener's feet by bringing early fruits and vegetables from the south, but the local products have the advantage in freshness. Consider also the advantage of securing crops of tender plants before the early frosts of September, such as tomatoes, squashes, and grapes, with a profit, with a gain of 10 to 15 days in ripening, and the dead loss without this leeway.

Nitrogen.—For most farm crops, and some garden products, the great want for large production is an increased supply of combined or active nitrogen in the form of ammonia or nitrates. In exhausted lands it is a pretty safe guess to say that active nitrogen is the missing link. In the free form, nitrogen makes up the great bulk of our atmosphere, and it surrounds and penetrates the plant every hour. Yet it is beyond the grasp of ordinary plants, though they may be starving for it. How to link the winds to plant growth, by giving them an unlimited supply of active nitrogen, is the great problem of agricultural chemistry, and the chemist who will solve this problem will be greater than a Columbus to discover new continents, for he will disclose new possibilities for all the old continents.

Nitrogen Accumulators.—It was formerly supposed that no plants, under any circumstances, could assimilate the free nitrogen of the air, but could only use the nitrogen in combination, as ammonia, nitrates, or the organic nitrogen of the remains of organic life. But it has lately been found that certain plants, such as the clovers, peas, beans, etc., by means of certain tubercles or warts on their roots, were capable of using free nitrogen in building up their tissues. This explains why the growing of clovers and peas, and plowing under their remains, have such enriching influence upon the soil. It is well known that a clover sod makes an excellent manure, and is a good preparation for setting out an orchard. A crop of peas fed down by a drove of hogs, feeds the soil as well as the swine. Green manuring is difficult on a fruit farm, and orchardists consider clover a heavy draft upon the soil, but it is not so if the whole crop is plowed under. The clover beetle is making the crop uncertain, in this state, and we need some substitute as a fertilizer crop. I think the value of peas as a fertilizer has been underestimated by our people.

Nitrification.—Nitrification, or the natural formation of nitrates from the vegetable matter containing organic nitrogen in the soil, is a matter of growing importance to farmers and fruitgrowers alike. Under favorable conditions of soil in regard to porosity, moisture, and temperature, in the presence of the microscopic nitre plant, the vegetable matter of the soil, which contains from one to two per cent. of nitrogen, is converted into nitrates to feed plant life with its most stimulating food. Most of the operations on the soil (draining, cultivating, mulching, etc.) have special influence upon nitrification. In compact, or water-logged soil, or one destitute of humus, nitrification does not take place; but in open, porous soils, moist but not wet, with a good supply of vegetable mold, nitrification takes place every year, and most of the year, when the soil is not frozen. It is a process of greater importance to this state than all the nitre beds and guano islands ever discovered.

Nitrate of Soda.—In the absence of a sufficient supply of stable manure, where green manuring is impracticable, and where nitrification is too slow, the next resource is nitrate of soda, or Chili saltpetre, and it will remain such till the nitre beds, like the former guano deposits, are exhausted.

A sample of this nitrate is before you. It is a very soluble salt, and the soil has little power of retaining it, and it tends to rapidly escape from the soil in drainage water. It should be applied at such times that the plant can make immediate use of the salt. The nitrates are not stored up in the soil from year to year, but are annually washed out of the soil by drainage water and carried off by rivers to the all-devouring sea. Nature seems to mix this stimulating draught for the plant, but throws it away if not drunk upon the spot.

The demands of plants for nitrates are somewhat unequal. Herbaceous plants call for more than those of tree growth. More is needed for succulent fruits, like berries, than for larger fruits, as apples, peaches, and pears.

Muck and Marl.—There are two abundant and valuable materials of the manurial class found in our state, muck and marl, but I need not stop to discuss these materials, having given my views in bulletin 115, issued in October. I will only detain you to examine these fresh specimens of muck taken from the big marsh north of the college, December 13.

1. Surface muck, fit for immediate use.
2. Cheesy muck, taken from beneath No. 1.
3. Slices of No. 2, dried in warm room without freezing.
4. Same as No. 3, but frozen and thawed, alternately, for two weeks.
5. Mossy muck, or undecomposed vegetable fibre—worthless.

By treating as in No. 4, or weathering, No. 2 can be brought into the condition of No. 1, and be a first-class material for immediate use.

Dr. KEDZIE exhibited samples of nitrogen, phosphorus, and potassium, and performed with them some interesting chemical experiments.

Speaking of commercial fertilizers, in response to questions, he said he once knew of a fertilizer selling for $22.50 per ton, to manufacture which cost but twenty-four cents per ton. He published an analysis of it, exposing the cheat, and was threatened with a $50,000 libel suit in consequence. The sellers of the stuff said they had on hand $16,000 worth of the fertilizer, and in consequence of his publication they could not sell a pound.

"Very well," he replied, "that's what I wanted to bring about. Go ahead." But the suit never was brought, and $16,000 were saved to the farmers.

Mr. WESLEY JOHNSON: I use a great deal of muck in my stables, as an absorbent, with straw, and haul it right out to the fields. Do I lose anything?

Mr. KEDZIE: What is your soil?

Mr. JOHNSON: Clay loam.

Mr. KEDZIE: It will hold all but the nitrates. They will wash away—the only waste in nature.

Mr. TRACY: Suppose one takes the cheesy muck, dries it, then moistens and allows to freeze; what will be the result?

Mr. KEDZIE: It will stay as hard as Pharaoh's heart.

Mr. J. A. LYON: If you had a tamarack marsh of fibrous muck, with nothing on it but tamarack and huckleberries, what would you do?

Mr. KEDZIE: Leave the tamarack and huckleberries. Methuselah might make tillable land of it, but the ordinary man can not. Lime will change the sour muck; wood ashes would be better. I can not be certain as to the time within which one of these muck beds, those not already tillable, could be brought under cultivation.

Mr. KELLOGG: How much ashes can be used to the acre—what is the limit?

Mr. KEDZIE: I would not hesitate to put thirty bushels per acre upon any soil; and forty, if light and sandy.

Mr. HAMILTON: What is the best way to apply lime?

Mr. KEDZIE: Apply on the surface and cultivate it in. If quick lime is used, slake it with water. The lower grades of lime, air-slaked, are quite as good.

Mr. M. B. WILLIAMS: Is there not great difference in ashes, whether of hard or soft wood, or of pine?

Mr. KEDZIE: Pine ashes are valuable; they have potash and much soluble silica. Ashes of soft woods are worth about twenty-five per cent. of those from hard wood.

Mr. A. ROBINSON: Are corncob ashes as good as ashes from hard wood, or better?

Mr. KEDZIE: They are better. There is forty per cent. of potash in them. Ten to fifteen bushels per acre of them may be used.

Mr. VAN AUKEN: I know a man who plowed under rye and turnips. Which of these makes the better manure?

Mr. KEDZIE: Best results would come from rye. There is as much solid matter in milk as in turnips, which are eighty-five per cent. water.

Mr. MUNSON: As to the amount of ashes per acre, I am now applying to my lands ashes at rate of 200 bushels per acre.

Mr. MORRILL: I put on 100 bushels per acre each year.

Mr. KEDZIE: I have no objection. You have plenty of ashes, or means to get them. I have been advising the average man, who is "short" on ashes.

THE NEW IDEAS IN STRAWBERRY CULTURE.

BY MR. R. M. KELLOGG OF IONIA.

The ideal strawberry patch may be said to be one in which the ground is wholly occupied with plants, each having an abundance of root pasturage, light, and air, and has the fruiting vigor and ability to bring the largest crops to the highest perfection, without the loss of energy in producing surplus foliage or unmerchantable fruit.

The ideal in strawberry-growing, as in everything else, is the very essence of perfection, and since there are many elements over which we can have no control, and which must enter largely into our calculations, entire success is not always attainable. Nevertheless, nature has well-defined laws which may be relied upon to produce certain results. If we understand these laws, many obstacles, which seem insurmountable, can be easily overcome. If we know the law or cause that produces the result, we can proceed with much certainty; but if we find certain results and attribute the wrong cause, we are thrown into confusion and uncertainty.

Figure 1.

Let us take a moment's time to consider some of these laws and point out some of the most prominent causes of failure of the average strawberry grower. We will begin at the beginning of his operations and follow him through to his harvest, and analyze his errors. The grower is told that his ground must be elevated and rich, that barnyard manure is the best fertilizer, and should be drawn from the stable as made, spread on the surface at once, several inches thick, and plowed under in the spring—all of which he proceeds to do with great care. He scratches the surface over with a barrow until somewhat fine, and lays off his ground with a marker, making a furrow from one to three inches deep.

After having gone to his last year's setting, or quite often to an old bed, and taken up the tip plants from between the rows, where they have stood freezing and thawing all winter, he takes a spade and chucks it in, moving it back and forward until he has made a glazed surface over all parts, which no feeding root can penetrate, whips in his plants, presuming to spread the roots out fan-shape but nearly always wadding them up [Figure 1] so they can not reach the soil, and so they sour and rot, poisoning the plants. He now puts his foot on the opening, and, as he supposes, closes it, but half the time leaves a large, open pocket at the bottom of the opening, where the soil does not come in contact with the roots.

In about a week or ten days' time he cultivates with a wide, long tooth, going down several inches and very close to the plant, often disturbing them, admitting air to the roots, and leaving the surface in lumps and ridges. The usual spring drouth follows; his ground dries out, many plants die, the rest make a feeble growth, and the harvest is a sad disappointment. Let us look for the causes of failure.

First we consider the action of water in the soil. Gravitation draws the water down; capillary action brings it again to the surface. What is capillary action? The word capillary means a "hair-like passage." We can best illustrate this action by taking panes of glass, tied together, one end tight, but at the other we separate them with a thin sheet of paper and set them in shallow water, on their sides. We notice the water passes up rapidly at the closed end, clear to the top; but, when the glass is separated by the paper, gravitation, being the stronger, permits the rise of water only a short distance. The same law obtains if we take fine, dry sand in a case and admit water at the bottom. It passes up rapidly to the surface, and, so long as the water is carried off by the hot sun and wind, it will continue to pass up; but if we loosen an inch or two at the surface, and make the particles of earth so far apart that gravity is stronger than capillary action, then the water will not pass. We illustrate this here by taking coarse gravel in a glass case and admitting water at the bottom, as before. But it rises only a short distance, because the interstices between the particles are so large, and hold so much water, that gravitation is the stronger, and water will not rise.

We here take another case, filled with fine sand, as before, but through the center we have placed a layer of chaff to represent the manure plowed under. You notice here that the capillary passages are broken. There are none through this chaff, nor are there any in the manure our grower plowed under; and the only means of bringing water from the subsoil was cut off. The water readily collects under the manure, but it can not get up to the roots, neither will the roots pass through the manure, because it is poison to them. Capillary action above the straw would continue, the soil having been trodden down by the men carrying and setting the plants and, the cultivation or loosening up of the surface having been delayed a week, the ground has had abundant time to part with its moisture.

Another serious error committed was in not pulverizing the surface before turning it to the bottom of the furrow. Assuming the soil was an ordinary loam or clay, with a firm texture, the plow broke the surface into lumps and the bottom of the furrow was filled with large air chambers which not only would not hold water, but admitted free air and greatly facilitated evaporation. The after cultivation was as deep as the rootage, with coarse cultivator which did not pulverize the soil, but left it loose so

the moisture in that part of the soil which the plant desired for a feeding ground was soon gone, and the roots were torn and mangled.

Another serious error was in marking the ground. There was no way to determine accurately how deep the plants should be set. The result was that those which were planted too deep rotted, and those set too shallow were killed by winds. Now, under all these conditions, you can readily see that, unless there were frequent and copious rains throughout the season, the plants must suffer. Now, we submit that the above method of fitting the ground and planting it is the one adopted by the average grower, and the difficulties could have been easily overcome by adopting other methods. I have said nothing about the hand weeding and extra work performed, and the difficulty on the market of selling fruit.

Let us now consider the ideal strawberry bed and how to produce it. The land has been manured the same as in the first place. However, if we had a choice of fertilizers (assuming there was a goodly amount of humus in the soil) we would apply a heavy dressing of fine ground bone and unleached wood ashes, as being more conducive to the production of fruit than making surplus foliage.

In the spring we should rake off all coarse straw and plow about five or six inches deep. A spading or disc harrow or cultivator will do as well. We now roll and harrow it until as fine as ashes, then plow about ten inches deep, taking care not to go deep enough to bring any subsoil to the surface. This plow is followed by a subsoil plow, going down from ten to twenty inches deeper, breaking up and pulverizing the lower strata so they will hold several times as much water, thus making a complete reservoir in this subsoil for the future use of plants. This subsoiling must be done very early in the spring, to get the benefit of rains to fill the broken ground. If late, I would not subsoil, because the particles would be too far apart to permit capillary action to bring water from the still lower strata. The plow we use for this purpose was made by the John Deere Plow Co. of Moline, Illinois, and is a perfect tool for the purpose.

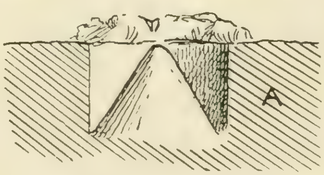


Figure 2.

We now roll and harrow until all lumps are mashed and the ground so mellow we could run the arm down twenty or thirty inches. We always firm the ground with the roller, to facilitate capillary action, and leave the surface even and smooth.

We now lose no time in setting the plants. We never take plants from a fruiting field, nor any bed which has been permitted to mature fruit, but grow from ideal plants, selected here and there and propagated in special bed for the purpose. We draw a line, merely making a mark, then, with the Perfection plant setter, we make a cone. [Figure 2.] A boy follows, taking the plant by the crown, turning it up, giving it a quick shake, and the roots quickly fall over the hand, when he [Figure 3], quickly turns it over the cone, so that the roots fall on each side, without

being crossed, and are never matted nor excluded from the soil, as in the case of setting with spade or trowel. No plant can be too high or too low, but must be just right; the roots are braced in every direction, so it can not be pulled out nor injured by the weeding machine. [Figure 4.] All plants set in the forenoon are cultivated with this weeder immediately after dinner, loosening up the surface and making a fine dust mulch an inch deep, under which the water will rapidly collect, being drawn up by capillary action from the subsoil. The plants make a vigorous growth at once.

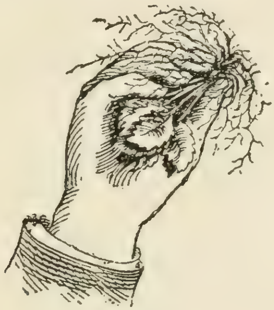


Figure 3.

The roots, not being bunched, have an abundance of root pasturage on all sides, and laterals start out in every direction at once. [Figure 5.] Not a single dead root can be found, but all are alive and doing their work. Not a missing hill should be found on an acre at the next harvest.

The weeding machine does all the work—no hand-weeding when plants are set in this way. If plants were set with spade or trowel, this machine could not be used, because so many plants would be set so low that the ends of the teeth would tear the crowns out; and many, being set so high, would be caught in the roots and pulled out. But, when set as directed, with the perfection plant-setter, I guarantee it will not injure a single plant, and it will do more and better work than any tool ever invented.

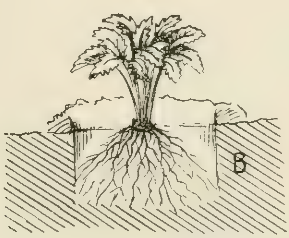


Figure 4.

The ideal bed is always grown in hills. Hill culture may be called the concentrating of many small plants with small roots and small fruiting crowns into one large plant, with long, large roots going down deep and far out in search of food and moisture to bring to great perfection an immense number of very large berries of richer flavor, finer texture, and higher

color. Its further advantages are that it prevents the exhaustion of the fruiting power of the plants. It is the maturing of seed that devitalizes the plant. There are as many seeds in a little berry as in a large one, and in this case the rootage is so abundant, and the roots go down so deeply, that the plant is abundantly able to withstand all the demands made upon it; whereas, in the thick matted row, the roots are short, merely going below the dry line. More than half the berries are too small to pick, but are left on the plant in large numbers, all dead ripe at once, so as to completely destroy its fruiting vigor. But in hill culture all the berries are large and picked as soon as ripe, so that, as a matter of fact, there are never more than a few seeds ripening at once.

More than twice the work of keeping the runners off is saved in picking, as there is no hunting through dense foliage to find them, as they are all clustered together, and their size requires only a few berries for a quart.

It also solves the question of drouth. It permits maintaining the dust mulch over the entire surface, save the little space actually occupied by the plant.

In applying the winter mulch we can put it on thickly enough to conserve moisture without danger of smothering the plants, as it can be put up close around the roots; whereas, in the thick matted row we are able to put it only between the rows, thus permitting rapid evaporation all through the wide row.

The great difficulty in hill culture, heretofore, has been in keeping the runners off. That objection is now overcome in the invention of the automatic runner cutter. It is used as a walking cane, merely placing it over the plant and pressing down about four inches. Two arms or fingers quickly pass around, gather up the runners, and draw them into two slots where the knives cut them off. A good active boy will go over two or three acres per day, and get more fun out of it than he would at a ball play.

Every time we cut a runner, the plant will form a new crown and fruit bud, and roots go down deeper, and new roots start from the new crown, and thus the plant is built up until it attains immense proportions. If the weeder is used, the plants should be set 30x18 inches; and, if we rely on the Planet jr. cultivator, set plants 30x30 inches and cultivate both ways.

The half-matted row is the next best thing. Set in rows 3½ feet apart by 18 inches, for cultivating with weeder, or 3½ feet by 30 inches for Planet jr., to admit of cross-cultivation. Cut runners as for hill culture, until the last of July, when the plants have become well established, the ground mellow and moist, and the drouth terminated. The plants have made large crowns, the roots grow long and well branched, occupying all the soil in the immediate vicinity of the plant, and will throw out large, stocky runners. The ground being moist, they will root quickly, and by fall will be much larger than those which have battled with the drouth and been threshed round all summer by the wind. There will be no hand weeding, because the weed seed has germinated and has been destroyed by the cultivator.

As soon as runners have come out into the row and made one plant, we run along each side with Planet jr. runner cutter, and clip runners off. This will cause the plant to root quickly and make new crowns. Care must be taken to pull the runners off between plants, in middle of the

row, and thin them out so they will average at least eight or ten inches apart, keeping the row not over twelve inches wide and giving them all an abundance of light and root pasturage.

My objections to the unrestricted matted rows are serious, and may be stated as follows: There is no money nor pleasure in growing berries in that way; it involves too much hand work and too much labor in selling the berries; the latter are always poor in flavor, color, and firmness; they spoil the market, because people will not eat them in great quantities. Who ever heard of a market being glutted with fancy fruit? It simply can not be done or, at least, there is no likelihood of its being done.

Figure 5.

The runners start out just as the drouth begins. They are thrown around and twisted into ropes by the cultivator, so many can not get to the ground at all, and none will root unless the ground is moist on top. The runners take all the strength of the plant, and keep it in an exhausted condition. The roots of a plant do not seem to be affected by the foliage of the runners as they do by its own leaves. The leaves are the lungs and stomach of the plant, and must assimilate all the food, and a large root growth will not be obtained without liberal foliage. The leaves on unrooted runners do not seem to perform this office only in a limited degree. Examine a very large plant, where runners have been kept off, and notice its immense rootage. Now, take a plant grown without restriction, with two or three times as much foliage or embryo plants, and those not rooted, and notice that the roots on the mother plant have made little growth. A plant, in respiring through its leaves, gives off an immense amount of water, several times as much as the hill plant, all of which must come from the short and insufficient rootage of the mother plant. But the worst of all is the inability to stir the surface soil among the thick-matted plants. The cultivator is narrowed up, and often the row is left fifteen or twenty inches wide. The crust forms, and capillary action brings moisture to the surface with the greatest freedom, and the ground soon becomes very dry to the full depth penetrated by the roots. The plant may be seen wilting only a few days after a good rain. If the drouth be prolonged, many die and others are stunted and will never make a free and vigorous growth, even after fall rains come. If it prove a wet season, and a vigorous growth has been made, the runners have formed so thickly

and been so piled upon each other, that many do not root at all, but remain as blanks to take the strength of the plant. You have no right to expect large berries when a dozen plants occupy the space which should be allotted to one. Light is the great promoter of plant growth, and when it is excluded by such dense foliage, no fruit can or will develop.

But here is the greatest objection of all: Fully one half the number of berries are too small to pick, but are left on the vine with hundreds of seeds ripe at one time to destroy the fruiting vigor of the plants.

The substance of this paper, then, is this: Fine and deep tillage, with a dust mulch to prevent evaporation; high fruiting power of plants, that there may be no blanks; plants set so as to create a rootage that shall sustain all drafts made upon it; restriction or concentration of foliage and fruit that there may be no lost energies, with an abundance of pleasure, profit, and satisfaction to the grower.

THE NEEDS OF MICHIGAN FORESTRY.

BY PROF. W. J. BEAL, AGRICULTURAL COLLEGE.

Dr. Beal prefaced his paper with some remarks concerning the reckless cutting of timber from the national preserves, and offered a resolution commending a bill in congress to prevent this, which was referred to the committee on resolutions, and subsequently adopted by the society. He then proceeded:

What is forestry? It is a business, like agriculture, an industry which is concerned in the production of a soil crop. It is the art of managing a wood crop so that it will make the best harvest of timber in the shortest time at the greatest profit. In forestry, unlike agriculture, it takes many years for the crops to mature, and the crop is then a complicated one.

In its most perfect condition, forestry is not a science nor an art, but consists in a dabbling in several sciences and several arts. It touches botany, chemistry, geology, meteorology, physics, geography, entomology, horticulture, arboriculture, lumbering, protection from fire, floods, and thieves.

One of the first things that occur to the younger members of such an audience as this is something as follows: What is the chance for a man to make a good living at this business, provided he have no capital except strong hands and a mind fairly well trained—he has very little experience, but may have considerable enthusiasm? My answer to this question is rather uncertain and unsatisfactory. It is certain, however, that there are no fat salaries now waiting for such men, so far as my knowledge extends. What the early future may bring forth, I can not tell. I am certain that there is a great opportunity for performing the work of a missionary in teaching the first elements of forestry. True, there are very few who care to be instructed. There is very little interest in the subject.

The masses of people in the country know but little about it. While they will listen eagerly to a speaker who discourses on remedies for some insect pest which has just devoured their crops, or gives some remedy for the apple scab or plum rot, or tells how to exterminate some vile weed, there are no calls for a speaker who will give the best modes of managing a reserved wood lot, or how best to deal with the subject of forest fires. We need 10,000 where we now have one who shall interest themselves in various departments of forestry. We need an enlightened public opinion on forestry. The Agricultural college is hardly doing its share to encourage the movement.

"Well," I hear some one say, "You, old fellow, are professor of forestry, and why not take hold of this matter and set the movement on its feet?" That seems a reasonable question; why not? The courses here are already replete with studies well nigh to suffocation, and no one can be found in our faculty who has any time he thinks he can swap off for lectures on forestry; on the contrary, each is begging for more time in his specialty—and the students hardly carry their present burden.

In the past, our state has made a few feeble efforts, at rather long intervals, by way of enacting laws on this subject. This is natural and to be expected, for the mass of people are little interested, and laws are of little benefit unless sustained by a healthful public sentiment. A man usually speaks of what he thinks, and sees what is in his head. Farmer A sees two cords of wood in a tree, or a nice lot of fence posts because he has firewood and fence posts in his head. He isn't troubling himself in regard to the benefit the tree will have on the farm crops of the neighborhood, nor the effect it has on the landscape, nor how it might benefit the next generation.

The subjects of forest fires and tree planting have received attention from legislators in many states, but often the laws are of little use; people dislike to complain of offenders. In the state of Maine and some portions of Massachusetts and Pennsylvania, laws pertaining to forests begin to be appreciated and enforced because of the persistent efforts of a few persons organized into societies. Michigan, a state specially adapted to tree growing, has done very little in this direction, except to permit everyone to cut and destroy as he chooses, provided he own the land on which he operates. No matter if he leave dead rubbish which in the next dry weather will most surely take fire and spread desolation for miles around. This is a free country! A man would be liable to arrest for putting a little sand in his wool or in his wheat to increase the weight; but he can kindle a fire with impunity that will ruin his neighbor's crops, spread to his buildings, and devastate his woodlands.

The value of the timber crop has been found to be in the United States about one third in value of all the crops taken from the land in a year. Many states enact laws to protect game and fish. The general government and some of the states have appropriated means to investigate the habits of the clam, oyster, lobster, whitefish, trout, etc., with a view to securing a better supply, by stocking the lakes and rivers with eggs of these edible aquatic animals, but our forests have been almost left to chance or the caprice of ignorance and selfishness. The supply of trees affects many industries; it affects the climate, the health of the people, the steadiness or uncertainty of the water in the streams, the amount of debris which accumulates at the mouths of the rivers. Considering its great importance in many respects, we are doing almost nothing for forestry.

Every state, especially with a forest interest approaching that of Michigan, should have a forest commission, whose usefulness should consist largely in educating and advising the people. Such a commission should aid in securing and enforcing laws pertaining to forests. The laws might refer to timber thieves or to the management of stump lands, or the reserve wood lots. Such a commission might see that forestry is discussed in conventions, in schools and colleges. It might be the means of contriving in some way the best methods of securing seeds and young trees for planting. It could secure good essays for the press or for bulletins by offering suitable prizes; it could collect statistics, answer questions, hold public meetings.

Much has been accomplished in Europe, but our peculiar customs and the difference in climate will make it necessary for us to experiment and devise means suited to our peculiar wants. For some years an active organization has existed in Pennsylvania, and one of the means of disseminating information among its members and securing the aid of newspapers has been a little journal called Forest Leaves. Let me read a few extracts from one of its pages:

The legislative bodies, recognizing this general apathy, and feeling that they had no popular support, declined to recommend any measures which appeared to have the active support only of the pronounced few friends of forestry. Then, too, there was a wholly erroneous idea prevalent that, in some way, it was proposed by the friends of the forestry movement to place legal restriction on the vast lumbering interests of the state, when, on the contrary, the sole object of the agitation was to perpetuate them.

In this condition of affairs, the public press of the state, as if by general consent, began to urge the importance of legislative action. Immediately a change was perceptible; it could not be otherwise, for the newspapers entered every household, and their solicitations for forestry laws were so direct, frequent, and forcible that an alteration in the thought of the general public was inevitable. It deserves to be recorded, that during the past winter there were hundreds of editorials and brief mentions of the forest interests in the newspapers of the state, and that out of these there were not half a score that were not urgently in favor of forestry legislation. It would be impossible to mention any one paper, when all were so active, but it should be stated that the newspapers of Philadelphia, without exception, were prominent in bringing about this revolution in public sentiment, and the forestry commission appointed by the governor of the state (who is heartily in sympathy with the forest cause) is now receiving the most cordial support of the newspapers. In a word, every chance is being given to show what is to be done, and how it is proposed to do it.

It would be unjust to omit mention of the fact that the agricultural organizations of the state have long recognized the need of forestry legislation, and have, to a greater or less degree, been influential in maturing sound views on this subject in different sections of the state. The state board of agriculture has, since its organization, made forestry a special feature of its work. Its reports were the first to contain any adequate expressions of the present conditions and future needs of the state. The service the state board of agriculture rendered the public generally has not been fully realized.

We may now speak in a more modest way of our own association. It was the first organization to make the preservation of our forests its single aim, and well illustrated the force of persistent, quiet effort. For years it appeared as if nothing was being accomplished, and at times its members were almost in despair of securing an appreciation of its work. It is now clear that results were produced which were of wider scope than at first supposed, and that the ideas inculcated were already securing public attention and gaining public support.

It is well to remember that all that was asked for was received, and that the association to a certain extent be credited or discredited by the results of this forestry bill. There never was an hour in which the association had so golden an opportunity as the present to shape the sentiment of a willing public in the best and most productive direction. The field is still one of a missionary character, hence we must raise the funds required to fully occupy it. Forestry literature must be freely scattered over the state. Every prominent citizen, every official, especially the judges, the members of the legislature, the county superintendents of public schools, must be directly or indirectly informed as to the work of the association.

The general secretary would report that he has within the year given about thirty public lectures upon forestry, the results being very encouraging. The most frequent calls for these lectures came from the farmers' institutes of the state.

From 1888 to 1892, Michigan had a state forestry commission, and during that time the interests in forestry made some progress. Since then, little has been done, because an economic (?) Democratic legislature voted the commission out of existence. Still, in some of the states and in the United States as a whole, the comprehension of the importance of the subject has kept advancing.

A few years ago Captian Eads was famous for the work he performed in constructing jetties at the mouth of the Mississippi to prevent the overflow. He seemed to have had a comprehensive view of the forest problem. Joaquin Miller of California wrote as follows: "I believe it is pretty generally conceded that our continent is being washed into the sea by way of the Mississippi and its thousands of miles of tributaries on the one hand, and at the same time swept naked of its native forests by annual fires on the other. I spent some time with the late Captain Eads at the mouth of the Father of Waters, inspecting his jetties two years ago. 'We have begun at the wrong end,' said this great man more than once to me. One morning he threw a bucket over the side of the boat and drew up several gallons of dark mud and water. 'There,' cried the great engineer, 'there is a mixture of one tenth Missouri, one tenth Illinois, one tenth Iowa, one fraction Kentucky, and so on, through about fifteen states, with an addition of about five tenths of pure water.' 'And what would you do, Captain Eads, to stop this washing away of the states?' 'As I told you,' remarked the energetic old man, as he dumped the ugly mixture back into the gulf of Mexico, 'we have begun at the wrong end.' But the country is not educated up to the point of beginning. It wants the other end for wheat and corn. It only wants the mouth of the river kept open so as to be able to sell its corn for the present generation and let the next generation look out for itself. The other end of the river has drowned out this end; state after state is going to be drowned out until some day the coral may again build its pretty castles where the people of Iowa are now digging wells for water. The United States is tearing away her very heart with her gang plows and dumping it into the sea, sir.'" Leaves of trees and grasses would protect the sources of the river.

Many experiments should be made for the benefit of the future. And here comes in the difficulty. Our people are so impatient for great results within a year or two after beginning, that they might be unwilling to undertake experiments requiring many years for reaching reliable conclusions. The details of the subject are too lengthy and comprehensive to be enumerated at this time. A study of existing forests should be made in many regions for a series of years, noting the changes that take place. This involves the anatomy and physiology of trees and shrubs, the physics and chemistry of the plant and of the soil, better methods of handling the product after it is grown, the study of the peculiarities of each kind of tree. For example, pines and beeches will endure more shade than black walnut and white ashes. Then, there is the undergrowth to be considered, mixed planting in strips and in blocks; also thinning and trimming.

The two words *forest fires* must strike a terror to many people of the state. I have taken no time to collect details regarding the great loss of life, and the suffering of those who lost their homes last summer, to say

nothing of the immense waste of timber and other property. The injurious effect of fire on young trees and on the fertility of the soil is very great. That most of these fires, with proper care, could have been prevented, no one will deny who has investigated the subject. In all, or nearly all, cases the fire had a modest beginning, but no one considered it worth his time to attempt to check its onward march. In case of fires purposely set, who ever attempts to find and punish the guilty? One thing is certain, and it should arouse the interest of every citizen: These flames in many cases were fed in their intensity by large quantities of tops and brush which had been left by people who had taken all they wanted from the forest. This is not the time to enumerate all the ways in which forest fires originate, nor to point out the numerous remedies, but to mention the subject as one of great importance, which should be discussed till remedies are found. Fires are most common and most destructive in the newer portions of the state, especially where cone-bearing trees prevail, and where clearing or lumbering is in progress.

The best modes of managing a reserve wood lot on the farm, and of preserving young green timber left standing after larger trees have been removed, is another problem of no ordinary importance. Neither of these parts of the subject seems to have attracted much attention of the owners of the land. It is well nigh the universal practice of Michigan farmers to pasture the wood lot, allowing cattle, horses and sheep to eat every green thing within their reach. This lets in the light and light encourages grass, and the advent of grass helps prevent seedlings from springing up, and also checks the growth of the older trees. The pastured wood lot is short lived at best. Then there is another feature of the subject almost never thought of, viz.: After cutting out the ripened oaks which are dying at the top, and the mature trees of other species, the second growth often consists too largely of scrubby beeches of slow growth. The open places might, with a very little effort, be supplied with seeds or seedlings of the most desirable kinds. As object lessons, we look in vain for models in our state, and a few good models scattered over the state would be worth more than many sermons. It may seem strange to you, but, in my estimation the greatest need of forestry is more persons who have a keener appreciation of nature —a love for trees in particular—persons who like to see trees, to study them, to admire their beauty, to read about them, and to discover their defects. We need to cultivate a healthful sentiment regarding trees, not exclusively as the author who says: "Woodman, spare that tree," but in a broader spirit which appreciates the uses of timber as well. We need more people who know the names and peculiarities of all our trees, the structure and uses of the wood—in a word, a little more botany and plant physiology.

Every teacher in our public schools should have considerable knowledge of our trees, then the children would learn of the teachers.

I have recently attended the first meeting of the Michigan Academy of Science, where the subject of forestry was considered among other things. I anticipate the society will be in many respects as useful as a college, and in some ways different in inducing the young to study nature more.

Now, since our fathers and grandfathers have hewn down most of the trees in the older counties of the state, and the pine has largely been driven back to the northern peninsula, people are beginning to think more about forestry. I have recently received two letters from William G. Mather of the Iron Cliffs Company, Ishpeming:

"DEAR SIR: My attention has been called lately by a trip to Europe and by conversations, to the art of forestry. This company has many thousand acres of hard-wood lands in this upper peninsula, and is cutting them off in the usual reckless manner, regardless of the future. I would like to investigate whether it would pay us to adopt regular forestry methods. Will you kindly refer me to some practical books or pamphlets on this subject, which would contain actual reports of forest workings on this plan, so that I would get at the actual facts from experience, as well as familiarize myself with the principles of the art? Again, do you know of any one competent to fill the position of forester for a large estate like ours, or whom I could consult, as with a consulting engineer?"

"DEAR SIR: Thanks for your letter and for the report of the State Forestry Commission, which I have read with interest. I would say that one cause for the indifference manifested is that so much of the forests belong to non-residents, who are desirous of realizing quick cash returns. Stronger legislation would touch them. I shall gladly speak to others on this subject, and would also coöperate for a state commission, I shall be pleased to hear from you on these matters whenever you are inclined to write and have suggestions to impart.

Lectures, illustrated, by competent people on this matter would, I think, aid much in arousing interest. Are there any such lecturers available?"

These letters show that the people of our state have now and then a little thought of our forests. Late in December, I received a letter from the U. S. department of agriculture, division of forestry, as follows:

"SIR: This office has been charged to formulate a bill for the action of congress, looking to increased facilities for the study of forestry in this country, the intimation being that the agricultural colleges should institute or enlarge their courses in that direction.

I am desirous, before making any suggestions, to ascertain how far forestry courses are carried on at present, and also to hear the opinions of the gentlemen who are concerned in this matter.

Will you be kind enough to give me replies to the subjoined questions? I must ask you kindly to do so without delay, as the time given for the formulation of the bill is very short and I wish to adapt it as far as possible to what appears practicable to the institutions concerned.

Respectfully,

B. F. FERNOW, *Chief.*

1. Is your institution giving any instructions in forestry (time alloted and subjects treated)? Outline of the courses offered.
2. Who gives the instructions, how prepared, and by what classes attended; obligatory or elective?
3. How long has the course been given and how many have attended?
4. Have you in connection with the college or experiment station, either woods that could be used for object lessons, or lands planted to forest, and how large, or are there forests in the vicinity that can be used to illustrate principles?
5. How, in your opinion, is it practicable to extend the course by congressional aid or otherwise?"

February 6, 1895, Hon. A. T. LINDERMAN of the Michigan house of representatives presented a bill which had for its object the study and care of our state forests, both the lands that have never been sold and those reverting to the state after the best timber has been removed. This is a move in the right direction.

Since writing the above, the state board of agriculture, after a few gentle hints from the professor of forestry, decided to vote to cut no more of the woods at the Agricultural college, where there is still left, in a more or less depleted condition, perhaps 150 acres. Movement is to be made at once toward making these acres of timber models of their kind. Different portions will be treated in different ways, to serve as object lessons.

Mr. Charles Wilde: Is it best, in planting forest trees, to have the ground entirely clear, or to leave the seedlings under the shade of larger trees, or even the small growth usual in wood lots?

Dr. Beal: This is a question about which there are two opinions; but in Europe it is the practice to clean the land off entirely, in "blocks," and let the new growth all come up together.

Mr. L. B. Rice, as a measure to encourage forestry, would have the state exempt from taxation all fenced wood lots, as well as afford some other aid to tree-planting, and make better arrangements as to highway planting.

Mr. C. W. Garfield: My father always loved trees, and gave me a deed to forty acres covered with young oaks. I cut timber from it carefully, made a winding roadway through the tract, and it was the one spot which I most enjoyed visiting. But the D., L. & N. railway was built through it diagonally, and this, with the fires they set, made such ruin that I sold the whole, and have planted seven other acres. I began at the bottom, in this work, and the trees have done well. I hope to establish the wild flowers among the trees. My father once opened a highway and left many of the trees, but the next pathmaster cut them all out; and not only this, but he went up and down a small stream which crossed this road, and cut all the bushes along its course, for which action there was not the least occasion nor excuse. A man on the Grandville road left trees in groups along it, and the effect was very beautiful, but the next owner of the place cut them all out except those which stood regularly sixty feet apart. He cut the trees into fence posts, which still lie where he threw them, the whole making the highway unsightly instead of the thing of beauty it was. I know of a little valley in some waste land which was filled with shrubbery and young white pines. Some one went there and cut them all down, although there was no need whatever for so doing. They ought all to have been left. Such people should die younger. Strips of woods along highways afford a pleasing contrast to the fields, and, where it can as well be done, the wood lots should be located near the roads, where they will afford pleasure to those passing by. No organization in the state has done so much as has the State Horticultural society for the advancement of forestry; for the state cut off the small appropriation given the forestry commission, and now there is left no organization but this to advance this noble and necessary work.

Dr. Beal advocated the planting of the hazel, hawthorn, laburnum, and other such shrubs, along the highways, with here and there a grape, making thickets and clumps of shrubbery to alternate with the maples,

elms, and oaks. "We have been called 'cranks,' Mr. GARFIELD, Mr. TRACY, and myself, for advocating these things."

Mr. J. F. WHITMIRE: Trees along the fences sap the fertility from the soil which is needed for the crops. Mr. BEAL or others should show that the trees are of value in protecting the crops. Until this can be done, there is no hope for wayside trees.

Dr. BEAL admitted that the crops close by would not grow so well, but they grow better elsewhere because the trees are windbreaks. "But I greatly prefer groups and thickets, with open spaces between, rather than trees in rows."

Mr. WILEY: These men (GARFIELD, TRACY, and BEAL) have not worked in vain, for they have helped create a sentiment which is increasing and is destined to do much good. The sentiment is constantly growing.

Mr. TRACY: The matter of loss of ground by wayside trees is often a serious affair, but there are many spots where crops can not be produced, such as knolls, "pockets," etc., and such should be used for the growing of trees.

Mrs. GOODRICH; Without such groups or other planting of trees, the cattle in the fields often suffer from exposure to hot sun and to storms. They should be supplied, if for no other reason than this.

Dr. BEAL: And yet I know of a farmer who cut down all his trees solely for that reason—the cattle, he said, would better be off feeding than loafing under the trees. (Laughter.)

MARKETING OF FRUITS IN 1894.

BY MR. GEORGE W. BARNETT OF CHICAGO.

The subject assigned me is about twelve months long, covering the year, but the main portion of this paper will refer especially to the time when Michigan products were on sale in Chicago.

It should be understood clearly that I never pretend to speak for any other market than the Chicago market, and this should be carefully kept in mind. The conditions that prevail in Chicago may be very different than those of Detroit, Toledo, or Grand Rapids, and representatives of each should speak for their own markets.

The year 1894 opened with scant supplies of fruit. Apples were the only offerings of nothern fruits, and these, mainly from New York, sold at about $3.75 per barrel during January. This price gradually increased until, early in May, $10 was occasionally paid; then $25, and in one case (and only one) $50 was paid by L. G. Kunze (a dealer in fancy fruits) for one barrel full of choice apples. Every apple was carefully selected, and the price was paid to establish a "record."

February brought a succession of storms, and March weather was not much better, so that, aside from oranges and lemons, but little could be sold.

April brought some strawberries from Florida and a few from Mississippi and Louisiana, but droughts and untimely frosts practically destroyed the first bloom of the strawberry plants. The second blooming produced some fruit in Mississippi and Tennessee, but the outcome was very unsatisfactory, and not until southern Illinois sent her crop did the market present anything like its normal appearance.

Notwithstanding the poor quality of much of the fruit, being small, inferior, and "buttony," the condition was excellent and the prices realized fairly satisfactory for these times.

The total output of fruit from the south to this market was quite small, and when the raspberries and blackberries were due, and the cherry crop from the south should have come, they were not forthcoming, which made a good market for Michigan small fruits.

I do not consider it within the province of this paper to treat the Michigan crop, or causes for short or full supply—that is left for others, I presume—but I name enough of the conditions to make clear my meanings. With the close of the marketing of the strawberry crop, which was cut somewhat short by the drought, came the great railroad strike that was announced for June 26. As it did not affect the steamer traffic, the supply of berries came forward with regularity, and, having little competition from receipts by rail, the prices were on the whole satisfactory, although the volume of business was too small to be profitable to either shipper or receiver.

The embargo on the railroads continued for about three weeks, and much fruit was lost by its operations; but the "consequential damages" were far in excess of nominal loss. It was not only the loss on the fruit that actually decayed while in the hands of the railroad companies, but the

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

demoralization of the various markets through the remainder of the season, from having an extra amount thrown on them for sale after the strike was declared "off." That should be considered.

One thing should be kept in mind, and that is, in these days no section has the monopoly of any market very long. Just as soon as a demand in excess of the normal supply is developed, efforts to increase the supply, or to procure substitutes, are at once put forth, and are usually successful.

California is now a recognized factor in the fruit supply in all the principal fruit markets in the country, and is taken into the calculations of every careful fruitgrower. It will not do to fold hands and sit down in fancied security, because two mountain ranges and a desert, besides a thousand miles, intervene between her growers and your market.

Rapid transit has annihilated space, when a train will travel 3,000 miles in six days, and refrigeration laughs at time; when a carload of fruit, twenty-eight days from the tree, sells for $1,300. A combination of the two factors makes California a very decided factor in the problem of fruit marketing.

When DEBS declared the strike "off," a thousand carloads of over-ripe fruit were hurriedly gathered and forwarded to market. This came too rapidly for the trade to absorb, and an accumulation soon became apparent, with disastrous effects.

By the middle of August, Michigan peaches began to move, and then actual "trouble" commenced. A fine crop of good fruit was grown, and the conditions all seemed favorable for fair prices at least, when the western tide was met and disaster followed. The prices gradually sunk from 35 cents per basket (1–5 bushel) to 30, and so on down, until, September 4, the prices were the lowest on record. On that day the receipts from Michigan were 115,000 packages, and there were sold 29 carloads of California fruit, of 24,000 pounds each, equal to 70,000 baskets of Michigan fruit. [See Figs. 1 and 2.]

The asking prices ruling that day at 9 a. m., the best hour in the day, were: Michigan, extra selected fruit, 35 cents per basket; standard grade, 25 cents, and inferior 10 cents. These figures were reduced, so that at noon selling prices were 28 cents, 20 cents, and 8 cents, respectively. California peaches, 20 pounds net, at the morning hour were 60 cents, which later were reduced to 50 cents. The cut gives relative size of package and fruit, and all were in sound condition. [Fig. 1.]

The same day, Michigan Bartlett pears, fifty-pound box, were offered at 75 cents, while California Bartletts were offered at $1.25 per box, same size. The cut shows but imperfectly the quality. Still, an idea may be gained by it, and perhaps it may induce some one to improve in packing, wrapping, etc. [Fig. 3.]

For further illustration, I give a view of the standard peach packages in general use, the baskets being the Michigan packages, and the box being the standard California package. [Fig. 4.]

But it was not peaches alone that suffered by the glut.

A choice article of plums was on sale at this time, and for the California article, for which 75 cents was asked for the four-basket crate, containing about 24 pounds, and the Michigan basket, holding ten pounds (when filled), was offered at 30 cents each.

From these figures I think the situation can be understood by all, and that the market was well supplied. Please remember that these prices were for standard qualities and conditions. Nothing out of order could be

sold at more than half these prices, for buyers could obtain all they could use at a considerable discount from prices named. In selling fruit "You can not get more than you ask," and seldom all you ask.

Do not think for a moment that this was an exceptional day. I have good reasons for saying that 150 cars of California fruit were held for days in refrigerator cars, and the receipts from Michigan for several days in succession were from 100,000 to 120,000 packages per day.

August 30 the prices were lower, but my illustrations were mainly taken September 4, so have used that date for fixing prices.

Of course, there is no profit to the dealer in handling fruit at such prices. The commissions will not pay the expenses at such figures; and, while the shippers lose, the commission merchants make no money.

I know of one firm that handled California fruit (that is sold at auction) who stated that the loss to the shippers, on eight cars of California fruit sold during the first week of September, was over $400 *besides the fruit;* that is, the eight cars lacked that amount of paying charges. The same firm held on track, for three to six days, seven cars, selling on the 10th and 11th, and the net proceeds on the seven cars amounted to nearly $1,700. But they said it was a "head-aching task."

I think this is sufficient on this point, and will only say the market never recovered from the "slump" to *paying* figures. A low range of prices prevailed throughout the season. Grapes were affected by it, and sold low, although not so low relatively as peaches.

Naturally, the shipper of inferior fruit suffered most. While taking the photographs, which are the product of a kodak camera, in one of the upper stories of our building, my attention was called to a "stuffed" basket, and, carefully taking off half the "stuffing" or facing, I took a snap shot at it. [Fig. 5.] It can be readily estimated as to the comparative worth of the "facing," which were of fair size, not selected, and the filling below.

I then took a fair sample of "toppers" and "fillers," and present them side by side, [Fig. 6.] that they may be impartially judged. Unfortunately, the number of the stencil was also taken, but I have not looked up the shipper's name. I am sure, however, he has nothing to do with the Michigan State Horticultural society. President Morill would not tolerate him.

California today stands at the head in fruit packing, and you will improve your market chances if you follow her example. It is for this purpose alone I introduce the illustrations, that you may realize the difficulties in the way of successfully marketing fruit that is inferior or improperly packed or scantily filled.

The season winds up quietly. Profits have been slight; prices have been low, for people must economize; and fruit is always second to bread in the mind of the laboring man.

Apples are $2 to $3.25 per barrel; grapes, Catawbas, 15 cents per 5-pound basket; California peaches, held in refrigerator cold storage, very poor, 5 to 10 cents per 20-pound box; pears, 60 to 75 cents per 50-pound box.

The general result has been unsatisfactory, although but few complaints are heard. The people remember times are hard and money close, and, whether grower or dealer, take the situation philosophically. No one expects the season to show any profit, and should by any possibility a margin be found in the transactions of 1894, it will be cause for profound thankfulness.

Mr. AUGUSTINE: I would suggest that when you Michigan people send down to southern Illinois your peaches in exchange for our good Ben Davis apples [laughter], you do not put better ones on top than in the bottom.

Mr. TRACY: And when you send up the Ben Davis apples, please do not put worse ones on top than are all the way through!

Mr. WILLIAMS of Douglas was doubtful if our fruit can be packed as is California fruit, without doubling the cost of packages.

Mr. J. F. WHITMIRE: California fruit is bought and shipped by great companies, and they know it does not pay to ship culls. If ours were so sent, the brands could be depended upon, but they can not be when the shipping is done by so many individuals.

Mr. MUNSON: The Grand Rapids commission men repack and "stuff" in the worst possible way. I brand my fruit, and warrant it, and find the practice pays.

SEED BREEDING.

BY MR. W. W. TRACY OF DETROIT.

Among the common misconceptions and ignorant notions regarding horticulture, there are none which result in greater loss and more unprofitable labor than those concerning seeds. To many people, seeds are a necessary addition to the soil in order to secure a crop, much as yeast is necessary in bread-making. We can not get on without it, but it makes little difference what we use if it will only work—will come up. Few people look upon a seed as simply a young plant with just as clearly defined possibilities and limitations of development as a young calf or colt. Many who would not expect a calf from a little yellow scrub cow, giving but a quart or two of thin, blue milk, to grow into as good and rich a milker as one from a well-bred Jersey, do seem to think that seed from one red beet is just as good as that from another, and should grow into just as crisp and tender beets. A great many of the horticultural failures grow out of this misconception of what a seed really is, namely, a young plant, packed with infinite wisdom for transportation. Let us examine the pumpkin seed. We tear off the outer protecting covering and find just a soft inner lining, and those two oval bodies which resemble leaves and would be easily taken for them, differing only in being thickened and white instead of green. Between these is a little bud, made up of perfect but minute leaves, all mounted on a tiny stem; but, you say in triumph, that is no plant, there is no root—how can you have a plant without roots? What are roots for? To hold the plant in place and collect food for it. But for one purpose, that of recovering bare spots from which all vegetation has been swept by storm or fire, we don't want a stationary plant; we don't want roots. Again, as to food, while our plantlet is in transit to its new home there is little probability

that it would be able to collect any food, no matter how liberally it was provided with roots, and so the roots are temporarily dispensed with and the necessary food to sustain it until established in its new home is stored in or about the plant itself.

Now, a plant is like a young child, in that its food must be in a liquid form—it can use no other, and all plant food is like milk, unstable, and soon becomes unfit for use. When we have to carry a motherless baby a long distance, we wisely provide and take with us some condensed milk which will keep indefinitely, but which, by the use of a little water and heat, is converted into available food. This is just what is done in the seed. The two leaflike bodies referred to are thick because they are crowded full of condensed plant food which will keep indefinitely if kept dry, but which under the influence of water and heat is changed into a form in which the plant can readily use it and thus be sustained until it has made roots of its own.

But seeds are produced in pods or fruits which follow flowers, and so are very different from plants. I have a plant at home called bryophillum. If I cut off one of its large leaves and lay it on the ground in a warm and moist place, it will form first buds, then leaves, and then roots at each notch along the edge, and we can cut away the original leaf and have as many separate plants as there were notches. Now, if we take a leaf like that of the basswood, cut off the two projecting sides, let it form along each edge first buds, then leaves, and in the place of roots, as did the bryophillum, let it store in the leaves some plant food and enclose them in a protecting envelope; now let the leaf be doubled up and the edges grow together, and we have, you see, simply a pea-pod full of peas. [As Mr. Tracy talked he illustrated what he was saying by cutting out of paper representations of leaves and making in them the changes referred to, thus giving a clearer idea than can be conveyed by mere description.]

I assure you, my friends, that while I have not used botanical terms, nor given you a scientific description of seed formation, I have given you the essential truths in regard to it, and I have not exaggerated in the least the intimate connection of the seed with the plant that bore it. I have not magnified in the least the truth that a seed is [not may become] a distinct individual, with similar potentiality and limitations of development to those of the young of the highest animal. Why, then, should we not talk of seed-breeding, just as we do of animal-breeding? If the colts sired by Hambletonian can be depended upon to grow up into faster trotting horses than the sons of some slow moving "plug," why can't we expect that the seed from a corn plant that produced two large handsome ears, will grow into plants giving more and better corn than that from some scrawny plant, which gave only one little nubbin? I don't need to ask the question, for it has been demonstrated, not only by theory but by practice, that they will. I know of an instance where a man sat down and wrote out a description of the ideal corn plant—the size of the stalk, the breadth of the leaves, the character of the husk, the ear, the grain. Then he went out to find it. He spent a whole day and found only a few ears which were up to the minimum excellence he decided he would accept. These were planted and carefully bred, with the result that, five years later, he was enabled to show twelve plants in a continuous row, all of which were as good or better than the best of those it took him a day to pick out five years before. Are our best animal breeders able to show any better or more reliable results of their work?

You ask how it can be done. Simply sit down and form a clear idea of just what kind of plant you want, and then write out a full description of it. Go out into the field and spend a day or two, if necessary, in getting a few plants which come the nearest to your ideal. The next season, plant the seed from each plant in a square block, one after the other, along one side of your field. Study these blocks, and you will be sure to find that some of them show more uniformly good plants than the others. Select the best block, get out the description of the ideal plant you started to breed, and select a few of the plants in this best block that come the nearest to your ideal, and save and plant them in the same way the next year, using the balance of the crop from the selected plants for your general crop.

There is not a particle of doubt that 95 per cent. of the farmers of Michigan could increase their corn crop an average of at least 5 per cent. by such selection of seed corn, and that, too, at a small cost of labor. Isn't it worth trying?

But mere increase in the money value of your crops is not the only thing I am pleading for. I need not repeat the oft told tale of the decadence of American farming, of the sons who fly away to the city and to ruin, of the daughters to whom farm life is a drudgery to be escaped at any cost. Why? Because to both farm work is dreary drudgery, nothing more. Would this be so if they were interested in such work as this? Would it not be a relief to the monotony of the farm work if more time was given to this kind of study and work? I do not need to argue the point. Every father's and mother's heart answers yes; and if by my talk I have opened up a way of developing greater interest in and respect for the intellectual possibilities of farm work, I shall not have taken your time this evening in vain.

Mr. J. A. PEARCE related an anecdote of his nephew, a young man who, discouraged with the lack of success with the old farm, in the ordinary lines of agriculture, sold it; but, as he could not bear to leave the old home, he bought it back again. Meantime he had talked with Mr. TRACY and had become inspired to renew work though along new lines. He began in horticulture and has well succeeded. Mr. TRACY should have the credit for good work done in this instance; and no doubt his good influences have been as potent of good results in other cases.

LAST YEAR'S WORK AT THE STATION.

BY EX-PRES. T. T. LYON OF SOUTH HAVEN.

It was not the intention, when the station was established, that its results should be secured by means of high culture and manuring, but by fair, average treatment in both respects, such treatment as the trees and plants would have among good growers in general, and we drop all varieties that do not thrive under such conditions.

The result with the small fruits, last season, was not most satisfactory, because of cold wet weather, followed by drouth. The currants have been infested by an insect that is not troublesome in the state at large, the twig borer, necessitating the cutting of much wood, and so the plantation has not been satisfactory. Mildew has made the gooseberries equally so until recently. Bordeaux mixture has been used freely, with marked success. We have had anthracnose of grape, blackberry, and raspberry, but in all three the Bordeaux mixture has been efficacious. Use of liver of sulphur upon gooseberries has made it possible to grow even some of the European varieties.

I concede the correctness of Mr. Kellogg's position, as to the culture of strawberries, on the whole, but we have not tried to go beyond the limit of average culture. There are over 200 varieties of strawberry on the place. This year, for the first time, we kept over a plat, so as to compare results of one and two-year plantations. Record was kept of both hill and matted-row culture of each variety, so as to make comparison of results in both treatments.

We have a quite large number of varieties of cherry, but are not yet able to speak definitely of the value of the new varieties for general culture.

Peaches take the most prominent position, because, perhaps, we are in the peach region. Most growers have no conception of the large number of local varieties of the peach existing everywhere in the state. We plant two trees of each kind. We find some very promising new varieties, but it takes more than two years to decide what are of real value.

There are a number of varieties of the sweet cherry, which is not generally regarded as hardy. Although it is not likely that the sweet varieties will ever become prominent in the market, there are some which promise to do so.

In testing plums we have to contend with the curculio, fungus, and rot. A number of the Americana and Chicasaw varieties are beginning to bear. The curculio works upon these as it does upon the domestic varieties, but in many cases the larvæ fail to develop. So far, therefore, these seem to be exempt, but none of them are equal to the domestic varieties, or in any way valuable. We are also testing some of the Japanese varieties, and some of them, likely, would have borne last year but for the May blizzard, when the bloom was killed. They bloom early, so are not likely to bear regularly. I can not advise the planting of them beyond the experimental degree. Several of them are very early, ripening by middle of July. But they lack in quality, even the best of them.

Most of the peach trees are of such an age as would have caused them to show a fair crop, but for the bad weather. Curl-leaf is the most serious evil with which we have to contend in cultivation of the peach. Last fall (1893), after the leaves fell, we used Bordeaux mixture, and the effect was very satisfactory in respect to reduction of this disease. There is a difference in the varietal susceptibility to curl-leaf, but even the worst of them, even the Elberta, was by this treatment rendered entirely free from it. Another fungus attacks the serrate-leaved varieties, but Bordeaux mixture subdued this also.

The same fungicide was at the same time applied to apples and pears, and again in the spring, after the blossoms had fallen, Paris green being added to it in the latter case. Only a few apple and pear trees as yet need this, as they are not in bearing.

Spraying on the whole has been very successful and profitable.

Fruitgrowers are invited to call at any time to see for themselves the various branches of the experiments, and they will be welcomed and given every opportunity to gain such information as we have to impart.

A REPORT ON BOTANY.

BY PROF. W. J. BEAL, AGRICULTURAL COLLEGE.

As the other members of the committee have left the report entirely to the writer, he will make the following statements:

Botany at the Agricultural college is tolerated, in my estimation, solely for what aid it can render agriculture and horticulture. I say it, without fear of contradiction, that no one now at the college, or connected with it for the past twenty-five years at least, has labored more strenuously in upholding all that pertains to agriculture and horticulture, than the writer, former statements by the press and by persons to the contrary notwithstanding. I have never offered any encouragement to students to pursue botany with view to becoming teachers of the science, though I have had many teachers among my students.

In our course, at present, a part of one term of the freshman year is devoted to laboratory and field work, with some reference to books in learning how to observe well common plants and become familiar with their structure and names of parts.

Another term is devoted in like manner to a study of some families of plants of most economic importance—for example, those including the plants grown in the orchard, vegetable and flower gardens.

In another term the compound microscope assists in a study of the minute anatomy of roots, leaves, seeds, etc., and in learning the functions of each part.

A third of another term is devoted to the study of forage grasses and clovers, and another third to weeds, their seeds, etc.

Three fifths of another term is given to the study of trees and shrubs of value for the orchard, vineyard, and landscape gardening, and this course is planned by and with the aid and consent of Professor Taft, with special view to assist horticulture and ornamental planting.

In the senior year the agricultural students may elect for a term the study of botany, but the time is not devoted to a general study of the subject. They study exclusively fungi which are injurious to farm and garden crops or to weeds, such as rusts, smuts, anthracnose, mildews, blights, molds, etc.

If any of the topics named above were taught in the laboratories of agriculture or horticulture they would readily be accepted as appropriate for those subjects.

To assist in this work, the botanical department has a very good equipment of microscopes, both simple and compound; maps, charts, and other apparatus, convenient rooms, many books and reports. A considerable number of the best books are furnished in fives and tens, in the laboratory, to use on demand. We have a fine herbarium, but, better than this for class-room work, we have a well arranged grass-garden of one hundred or more species, a weed garden of eighty species, and a beautiful botanical garden of about one thousand species, and an arboretum, to say nothing of the endless list of things to be found growing on the campus, on the farm, in the orchards, gardens, and greenhouses.

There are almost too many, as they sometimes tend to confuse and perhaps discourage the beginner.

Recently Professor Taft has undertaken to plant a grove exclusively devoted to trees and shrubs native to Michigan. Although we have them nearly all elsewhere scattered about, in this plat they will be together with no foreigners to confuse the student.

The trees and shrubs of the world are now in process of grouping into natural families on the campus. In one suitable spot the elms and their relatives, in another the willows and their cousins, the poplars; elsewhere the oaks and their allies, and in yet other places maples, and so on.

One, or perhaps we should say two, rooms of the laboratory are used by the experiment station. Immense numbers of weeds, wild plants, grasses, seeds, etc., are sent from all sources for identification. To aid in this work, first comes a good man for the place, C. F. Wheeler; second, a large herbarium; third, some 1,500 lots of seeds of weeds, etc., in small bottles, all labeled. Every day the professor of agriculture or of horticulture, or some of their helpers or some of our students call for assistance in solving some botanical puzzle.

Every week, nearly, there is a meeting of the botany club or natural history society, which in reality are horticultural or agricultural clubs.

We have no botanical, agricultural, or horticultural museums worthy of the name, but quite a good many specimens stored away waiting for the State Board of Agriculture to muster courage enough to ask for money with which to erect a suitable buiding.

I have just come from the first meeting of the State Academy of Science held in the capitol. The objects of this society have an economic trend, probably influenced that way by work of the Agricultural college and such societies as the one here assembled. Its objects are to advance the interests of agriculture, botany, forestry, zoology, anthropology, omitting horticulture owing to the existence of a state society especially founded for that subject.

I call your attention to the work of this society, believing that it will interest many of you.

No special investigations in plant physiology have been undertaken for this report.

A REMARKABLE PEAR.

BY MR. HENRY AUGUSTINE, NORMAL, ILLS.

Mr. HENRY AUGUSTINE of Normal, Illinois, on invitation of President MORRILL, told of a pear tree in his state that is of extraordinary size and fruitfulness. Mr. AUGUSTINE said there are as yet no trees of the variety in the market, but there will be presently. It is the policy of the Illinois state board of horticulture to investigate promising seedlings of any kind, and it was this practice which caused them to become familiar with the Sudduth pear, as the prodigy is named. Another pear which they have found to be excellent is named the Lincoln pear, a seedling of exceeding great promise. The original Sudduth tree is fifty-eight years old. Young stock from it is very strong and thrifty. A few years ago Mr. TITUS SUDDUTH, who owns the original tree, coaxed me to propagate a few young trees from it for him. I pulled them up and gave them to him, but inquired about the trees after they got into bearing, and was greatly surprised at the result. The trees in size look more like elms than pears. I shall set an orchard of them. It is said, upon what is considered good authority, that the original tree has borne 120 bushels of pears as a single crop. Mr. AUGUSTINE read the following papers descriptive of the Sudduth pear:

Regarding the Sudduth pear, I consider it a new variety; or, if an old one, it is an unknown one to me, both in fruit and wood.

I learned the following facts by personal observation, measurements, and from conversation with Mr. SUDDUTH and others owning the land where the trees are growing but who are entirely disinterested so far as the propagation of the trees is concerned.

Mr. SUDDUTH told me he was 65 years old and that the tree antedates him at least nine years, which would make the tree 74 years old.

His first boyhood recollections were formed while living with relatives in a house a few yards from the tree under whose branches the children played. He has never seen a blighted twig on the tree. So far back as he can remember it has borne fruit every year. He is confident that it has not failed to bear annually for the last forty years, considers the fruit of good quality and exactly alike on all the trees young and old. He has made repeated plantings of quite a number of standard varieties but they are all dead and gone and the Sudduth survives them all. The "old tree," the one from which the scions were taken that propagated the others, Mr. IRA KNIGHTS told me was grown from seed brought from Ohio by THOMAS CONSTANT, a relative of his wife. Mr. C. planted it on land he bought of the government and sold to Lincoln's law partner, Judge STEPHEN A. LOGAN, and by him sold to its present owner, TITUS

SUDDUTH, after whom the pear is named. The seed was planted in 1820, making the tree 74 years old, or two years younger than the state of Illinois. It is growing in rich, deep, black prairie soil. Mr. KNIGHTS and I measured it with a long tape line and found it to be ten feet in diameter four feet from the ground. A little higher, where the limbs start out to make the head, it measured fourteen feet. The head of the tree is about eight feet high and consists of six branches and one main stem. The smallest branch measures three feet four inches around. The tree bore this year about thirty bushels of pears. This being an off year, it was not a full crop. It has borne eighty bushels in one season. Mr. KNIGHTS showed me two trees on his own farm that he knew to be fifty-two years old. One measured seven and one half feet, four feet from the ground. We took a sixteen-foot water-spout and by leaning it against the tree estimated the tree to be about sixty feet high. The tenant on the farm said that the tree bore from twenty-five to thirty bushels the past season of good fruit. He had known the trees for fifteen years and had never known them to fail.

On the farm of J. W. YOCUM is a row of five trees, set in the edge of an apple orchard. The trees varied in size from eight feet seven inches to nine feet in circumference. Mr. YOCUM told me he was forty years old and that his father planted the trees before he could remember, in 1836 or 1838, making them at least 56 years old. The fruit ripens in September, and this year the five trees bore at least 150 bushels. They have borne every year as far back as he could remember. On the farm of JNO. R. JONES there were formerly two trees. One was blown down four years ago. The remaining one is about 49 years old. Comparing it to Mr. JONES' house, standing a few feet away, we estimate the tree to be sixty feet high. He had owned the farm since 1860 and the tree had borne every year since. In Mr. SUDDUTH'S garden are seven trees said to be four years planted, one of which measured one foot two inches one foot above the ground, which was certainly a remarkable growth for that age.

Several limbs had broken from the large trees, years ago, and the stubs not having been removed as they should have been are in a more or less advanced stage of decay. On the body of one of the small trees was a dark spot somewhat resembling blight, but possibly caused by an accident. With these exceptions, I found no disease, decay, or blight on any of these trees.

I talked with five men who owned land on which the trees are now growing, or tenants who cultivated the land and have a share in the fruit, all of whom stated that they had known the trees from fifteen to forty years and all agreed on the following points: The great age of the trees, their freedom from blight, their habit of annual bearing, and the good quality of the fruit.

I examined the trees December 15, 1894.

T. E. GOODRICH, Cobden, Ill.,
President of State Horticultural Society.

I first knew this wonderful pear tree in 1835, the seed of which was brought from Xenia, Ohio, and planted in 1820 by Mr. THOS. CONSTANT, who entered the land from the government. Later on, about 1845, the size of the tree its heavy bearing quality, as well as the superior quality of the fruit, attracted so much attention among the old settlers

that I observed it more carefully; and in 1862 I bought the farm on which the tree now stands from Judge LOGAN of Springfield, ABRAHAM LINCOLN'S first law partner.

I am confident that for the last forty years the tree has never failed a single year to bear a crop of pears, and to the best of my judgment it has borne eighty bushels of pears in one season. During the last forty years I have annually eaten pears from the tree, and myself and employes regard them as delicious fruit. I have never seen any wormy pears nor a blighted leaf on the old tree nor any of the trees grafted from it. I regard it a more hardy and a more prolific bearer than the wild crab-apple.

In addition to its good qualities as a dessert fruit, the pear is much sought after for canning and preserving, and, when sold by my tenants, has always brought the highest market price wherever known.

I would estimate the height of the tree, before the top was broken by heavy loads of fruit, to have been over fifty-five feet, the trunk measuring over ten feet in circumference. I have also a number of young trees propagated by Augustine & Co. of Normal, Illinois, that are six years from graft, and three years after setting in the orchard they fruited. I have also observed the five trees that were grafted more than fifty years ago from the old tree, by Mr. YOCUM, and find the same characteristics in them as that the old tree possesses — long life, hardiness, productiveness, annual bearing, vigorous growth, etc. During these years other varieties of pear (Bartlett, Flemish Beauty, Seckel, Angouleme, etc.) have been planted in the vicinity and one generation of them after another has passed away, but the old tree still stands as a landmark of much interest, especially to the old settlers.

TITUS SUDDUTH.

DISCUSSIONS AND REPORTS.

GOOD AND BAD PEACHES.

Discussion of the peach question was begun by an inquiry from Mr. Johnson for the name of a good yellow peach ripening before September 10. He was told that St. John is such a variety.

"What about the Kalamazoo?" was asked.

Mr. MORRILL: I have fruited it three years; it is hardy, very productive, needs thinning; is of rich flesh and flavor, has an excellent skin for shipping; bears early; is in general a grand, good peach; ripens between the Crawfords, is about the size of Early Crawford, and is very uniform; is but little troubled by curl-leaf, and there is scarcely a finer peach of any season.

Mr. A. S. PACKARD agreed to this commendation of the Kalamazoo as it had come to his acquaintance in his own orchard.

The Elberta was said to be in size, on young trees (the only age now bearing in this state), equal to the average of Late Crawford on old trees, and to produce very few culls; it is somewhat subject to curl-leaf, but this disease is now under control by use of Bordeaux mixture; some of Mr. Morrill's two-year trees bore a bushel each last season.

"Is it advisable to set peach trees 12x18 feet apart and cut out every other one when they have grown large enough to cross?"

Mr. Morrill: Who ever knew them to be cut out when set that way?

A voice: I did—by yellows!

Messrs. Morrill and Packard advised against such planting, the latter saying he would never set peach trees less than twenty feet each way. Inquiry was made as to the R. S. Stevens peach. Mr. Lyon said he could not say much for it. The fruit is small and the tree a slow bearer.

Mr. Morrill: It looks like a small Barnard. The fruit is good but the variety suffers from disease or climate more than does Golden Drop under similar conditions.

What of the Champion?

Mr. Lyon: So far it shows well; it is of good appearance and quality; ripens one week before Early Crawford, which means, in Michigan, the second week in September.

The proper spelling of the name of Crosby, applied to a peach, was stated by Mr. Lyon to be as here printed. This peach, he said, is slower in bearing than the Champion.

The Wheatland was said never to bear well—usually but two or three fruits per tree. "You will never get more than about half a dozen to the row, no matter how long the row is!" One member said this variety in his orchard bears better than the Crawfords, is very fine in quality, making for him more money than any other sort.

The Schumacher?

Mr. Lyon: It is a poor thing.

Mr. Morrill: I guess that's so.

Another gentleman said it was a little better than Alexander.

Mr. Morrill: Down our way we shake all such things up in a bag and throw them away!

The Wager?

Mr. Pearce: I regard it as a failure.

Mr. Lyon: Mr. G. C. McClatchie of Ludington regards it as one of his best.

Mr. Brown: I have had large crops from it, ripening about with Early Crawford.

Mr. WILEY: I have a peach I bought for Wager; it is very yellow, as much so as Golden Drop; in seasons of drouth it becomes dry and mottled; this defect is only partially overcome by thinning; it is hardy and prolific.

Mr. PEARCE: My experience is the same as that of Mr. WILEY, and so I think that what Mr. BROWN has is not the Wager; in good seasons it is a good peach—it is good on the average.

Two others said they had Wager and that the fruits drop and must be sold as culls, though their quality is good.

Mr. LANNIN: I would not set Wager, and must place Richmond with it as to worthlessness.

Snow's Orange was commended as "one of the best peaches a poor man can plant."

A lady enquired as to the Globe. A member said he waited nine years before he got a good crop of Globe; he has fifty trees.

Mr. MORRILL: It is nineteen years, I guess, that I have been trying to get one.

Mr. LYON was appealed to, but made no answer.

Mr. MORRILL: He shakes his head; he's not old enough to have gotten a full crop.

Diamond was said to be a very rich peach—the best of all peaches in quality. It ripens with the Late Crawford, said Mr. MORRILL, but is not quite so large as that peach; it is uniform in size, a very handsome thing. I think I shall set more of it, to sell as clings, for there is a demand for clings.

COUNTY REPORTS.

Mr. D. W. WILEY, reporting for Allegan county, said: There were certain new experiences to the fruitgrowers of western Allegan county, last season, among them the most severe drouth known to that region. Yet the peach crop was much better than we expected it to be, showing what cultivation and thinning will do. We had expected almost complete failure. The season showed strikingly the effect of cultivation. Those orchards which were not cultivated are in bad condition now. Apples were a poor crop, Oldenburgh being the best of the fall varieties. It was not so much affected by the codlin moth. Winter apples were a very poor and light crop. There are differences of opinion among the growers as to the value of spraying apples. The strawberry crop was a good one and brought paying prices. Pears were a moderate crop, blight appearing to a considerable extent.

Mr. C. J. MONROE of South Haven: I can add little to what Mr. WILEY has said, because it so well covers conditions in my vicinity. There was a

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moderate crop of small fruits, which returned good prices, the strawberries being best of all. The apple crop was a medium one, as to quantity, but of poor quality. Many orchards suffered from the canker worm. Grapes, at Lawton, sold at fair rates, but there was only a moderate crop, some growers losing all by the May frost. There will be a great increase in the setting of fruit trees and plants of all kinds next spring.

Mr. A. S. Packard of Covert: The same conditions obtained in my vicinity as related for the others to the north. Small fruits were generally good, with strawberries extra; gooseberries were not a full crop, and the apples were poor. Apples used to be good with us, but have of late years failed, becoming scabby. I sprayed one hundred peach trees, in the winter, for curl-leaf, with Bordeaux mixture, under the direction of the California experiment station, and the effect was very noticeable when the trees were in leaf. I had a three-fourths crop of peaches. Smock was light, and Crawford a failure although such had not been the case before. From two hundred and eight peach trees, four years old, I harvested three hundred and eighty-six bushels, besides what we used and gave away, and received for them $360. Peach prices were good. My business is largely with order trade, very little fruit going to Chicago.

Inquiry was made as to the effect of the lake upon apples. Mr. Wiley said the best apple orchards of which he knew were within three quarters of a mile of the lake, and had always been successful till the general failures of three years ago. So he did not think the influence of the lake detrimental.

Mr. J. A. Pearce of Grand Rapids: Apples, where uninjured by the canker worm, were a fair crop, nearly full; but many trees suffered injury of that kind, rendering them useless for two years. Peaches, plums, and pears were full crops. Late frosts hurt raspberries and grapes. Strawberries were injured by the drouth of the preceding year, and so were not full crops except upon young and well kept plats. Spraying of apples is conceded to have been very beneficial, where well done. My Wageners were sprayed, with fine results, while the fruit of other kinds, untreated, was worthless for anything but cider. I sprayed with Bordeaux mixture twice—once before the leaves appeared, and again, with Paris green added, after the blossoms fell. There will be a large setting of fruit of all kinds, except apples. What was one of our best apple orchards, has been taken out, to make way for peaches. Over 300,000 bushels of peaches were raised about Grand Rapids. No variety wholly failed, though Wheatland was but a partial crop. Mixon was good. There are but few Globes, and these bore about with Wheatland, a little better, perhaps.

Mr. A. Hamilton of Ganges: The peach buds in Ganges were unusually large, at the falling of the leaves, and have not grown smaller since. The wood is in the best of condition.

Mr. Dressel: The same is true as to Oceana county. This is not considered bad, but rather as showing more perfect development than usual. All fruits were good in this county, except apples. Of peaches and plums there will be a larger setting than ever, with few apples and less pears.

Mr. R. M. Kellogg of Ionia: There were no good apples, a condition due to scab. Pears were very good, as were peaches—more of the latter than for several years. Small fruits were good, especially raspberries when cultivated, and all varieties of the strawberry. There will be a large setting of peaches, with not so many pears and fewer apples.

Mr. W. K. Munson of Grand Rapids: Sales of fruit in the city are better than from shipping. Grapes were hurt by frost, in irregular ways, some losing all, and others none, though close by.

Mr. Malcom Graham of Jonesville: The northern part of my county gave a good crop of cider apples. Spraying made them no better—no better for cider, of course! Pears were good, but there are no peaches grown there, of any amount. Small fruits were a good crop and sold well. There will be the largest setting ever known of peaches, plums, and pears. There will be a large planting of small fruits. But few grapes are raised, but what were produced were good.

Mr. L. B. Rice of Port Huron: There were not enough apples for the home demand. Strawberries were good and very cheap, raspberries few and high, blackberries dried up. We have had some peaches the past five years, though it has been supposed we could not grow them; there is no yellows. Peach planting will be very extensive next spring, as it was last year. Of pears and plums, many will be set. Only one man of my acquaintance sprays, and, as he insists upon using no lime, he burns his trees. The northern part of "the thumb" had large crops of apples for a few years, but none this season, so there is no evidence of its special adaptability to this fruit.

Mr. Thomas Wilde of Coopersville: All fruit crops were good. There will be a large planting of peaches and apples the coming season. I like the idea of spraying, but am not satisified with the compounds in general use. I use corrosive sublimate in preference.

APPLES DIRECT TO DENMARK.

At one of the sessions a letter was read by the secretary, which had been sent him by Gov. Rich, relating to the shipment of apples direct to Copenhagen. The season was then so far advanced as to preclude the

sending of the fruit to the seaboard, and therefore nothing came of it. But it would be well for such growers as may have choice fruit for sale next fall, to put themselves in communication with Mr. SOGAARD, who is now again at Kansas City instead of at Copenhagen, where he was when the letter was written. It was as follows:

COPENHAGEN, *Denmark, Nov. 21, 1894.*

His Excellency the State Governor, Lansing, Mich.:

DEAR SIR—There has for the past few years been an increasing importation to the Baltic countries of canned and evaporated American fruit, mostly from California. This year there will also be large importations of green apples. I have been prompted to call your attention to this matter, because the articles referred to could undoubtedly reach these countries at considerably less cost from the eastern states; and, inasmuch as your state it an exporter, I trust your Excellency will be sufficiently interested to make the fruit exporters of Michigan acquainted with this probable opportunity of getting a new market, which can be reached about as cheaply as can the trans-Mississippi states, where their surplus is now consumed.

Copenhagen has two direct steamship lines to New York (Funch, Edge & Co. are the New York freight agents of the "Thingvalla" line), and has weekly connection with Baltimore (Patterson, Ramsey & Co.) via Liverpool and Hull.

I have, during the past three years, done something to effect more direct trade relations between the United States and the Baltic countries, which are more or less tributary, commercially, to Copenhagen. I am here at present to advance the work referred to, and shall be willing to place any fruit exporter in your state in communication with some responsible Copenhagen firm, who, through their agents at the smaller ports, can reach the entire Baltic market. And here let me say that Copenhagen has distributing coast steamers to nearly thirty ports in Sweden, Norway, Finland, and the Russian and German provinces on the Baltic coast.

Michigan fruit exporters can write me care of the Department of Foreign Affairs, Copenhagen, Denmark, or, as the season is already late, they might, to save time and correspondence, send small samples at once and quote prices of goods delivered on board the steamer.

The Balwin apple is known by all fruit importers here. American green apples have in former years come to this market throrgh Hamburg agents, but there is no need of those middlemen. T. SOGAARD,

Danish Vice Consul at Kansas City, Copenhagen.

APPLES FOR NEWAYGO COUNTY.

The secretary read the following letter from Mr. Geo. A. DAY of Newaygo:

NEWAYGO, *December 19, 1894.*

DEAR SIR—I am going to set ten acres to apples next spring. What variety would you recommend? What do you think of the Shackleford, Arkansas Beauty, Jonathan, Akin, Babbitt? My soil is gravelly with clay subsoil. GEO. A. DAY.

The secretary said he had told Mr. DAY that of the above list only Jonathan is known in Michigan, and, as for the rest, he would better let them alone, as not having been tested in this state, and use instead the standard Michigan varieties, Baldwin, Spy, and others, especially such as he found had been successful within his his county or vicinity; and had expressed a fear that Mr. DAY had fallen into the hands of some tree agent who wished to sell him the stock he had, at fancy prices, instead of the kinds Mr. DAY should be allowed to select for himself.

Mr. MORRILL: Our secretary has stated the case truthfully to Mr. DAY. No one from Michigan knew anything of either of the varieties mentioned, except, of course, the Jonathan.

Mr. AUGUSTINE of Normal, Ills.: Aikin's Red originated in Kentucky, and there are a few orchards of it in Illinois, but I would not advise the planting of it generally. Shackleford, the same—originated upon the same farm. Babbitt is an Arkansas apple, but I know nothing further about it. I would not plant many varieties in a commercial orchard. If I were planting 10,000 trees I would not have more than four or five varieties. I advise no one to plant until he knows what has been successful near him.

Thos. WILDE of Herrington: Oldenburgh and Yellow Transparent are the only kinds of which I know, which have been successful in Newaygo county. Some of the crabs would likely do well.

Mr. VANAUKEN: I saw at Fremont, in that vicinity, last fall, apples equal to any shown here. I do not know what sort of soil they were grown upon, but in the farmer's wagon where I found them, Wageners, Spies, Baldwins, and some others, were all dumped in together. They were so fine that I gave him one dollar extra for a barrel of the fruit. It was very choice. Mr. MORRILL has sampled them at my house.

Mr. MORRILL: They are certainly good.

Mr. SESSIONS: The Spy is very successful in Oceana county, west of Newaygo, also the Baldwin and Wagener. Much of Newaygo is well adapted to apple-growing, to these sorts, and I would recommend them.

Mr. AUGUSTINE: How long before the Spy bears in that county?

Mr. SESSIONS: Twelve years, but it makes up for it afterward.

Mr. AUGUSTINE: I do not like the Spy, because it is eighteen to twenty-two years to bearing in any region I ever heard of, and in marketing it must be handled as carefully as eggs, for its skin is so very tender.

Mr. POST: Would grafting the Spy on other stocks, using scions from bearing trees, make any difference?

Mr. MORRILL: Yes, and it would make a difference with any kind of apple. You would get several years' start in the stock.

A VARIETY OF TOPICS.

RELATIONS BETWEEN MICHIGAN AND ILLINOIS.

Responding to a call, Mr. HENRY AUGUSTINE, the delegate from the Illinois State society, said: I do not like to say much here of horticulture, least I mislead some one, for I am in a strange land, a land of horticultural wonders. I have learned many things which are peculiar, such as the injury to a grape crop in one place while the adjoining vineyard wholly escaped. When one of us suffers in Illinois, all suffer together. I have been puzzled to know how you can grow peaches here, when we can not grow them at all, but I begin to see. Michigan horticulture is of great value to Illinois, for the reason that it is so largely different, and supplies us with choice fruit which we can not ourselves successfully produce. There are 400,000 acres of apple orchards in Illinois, yet we feel justified by the demand in planting more. You of Michigan, keep on growing your fine peaches; send them down to us, and we will return for them good Ben Davis apples.

A Voice: Send them all to Denmark.

DO FRUIT BUDS OF VIGOROUS TREES AND PLANTS BETTER RESIST FROST?

President MORRILL told how the use of wood ashes and ground bone in his peach orchard, by making stronger wood and buds, had saved it from damage by frost. He thought it probable that Mr. MUNSON's vineyard was saved by some such condition of good fertility of the soil, when the vines of his neighbors suffered.

Others contended that differences in soil had chiefly to do with exemption from frost, not only as to kind of soil, but elevation, air drainage, depth of water from the surface, etc. Tests should be made as to the liability of localities to frost, before extensively planting the grape.

Mr. MUNSON: Now you see how I get amusement, asking people why their grapes were hurt and mine remained unharmed. I get all sorts of opinions, but none can tell me anything about it, save that it is some peculiarity of the place. The longer we live, sometimes, the less we know.

Mr. MORRILL insisted that while there were these peculiarities in lands and locations, still, better fertility has very much to do with the resistance of plants and trees against not only frost, but other untoward conditions. He believed it had very much to do with Mr. MUNSON's exemption.

TILE DRAINS IN ORCHARDS.

Mr. CHARLES WILDE: Has any one had experience in tile draining an orchard?

Prof. TAFT: If the tiles conduct spring water, there is danger of the roots of trees entering them; but if only surface water flows through them, there will be no trouble from this source.

Mr. PACKARD: A neighbor of mine had tile in an apple orchard, on clay soil, some of which he took up and found to be full of apple roots.

TREATMENT OF APPLE SCAB.

A Member: What is the best treatment for scab of the apple?

Prof. TAFT: Bordeaux mixture, twice, if rainy weather occurs, before the buds open, and again after the buds are formed, but before they open; for the scab attacks the flower stems, destroying them. Bordeaux mixture makes healthier foliage, and, therefore, stronger trees.

LEAF BLIGHT OF PEAR AND QUINCE.

Mr. M. E. WILLIAMS: Has any one tried Bordeaux mixture for leaf blight (not twig blight) of the pear?

Mr. R. M. KELLOGG: I have tried it and found it successful.

Prof. TAFT confirmed this, and said it was equally efficacious against blight of quince leaf, but not so as to the twig blight of either.

AN ILLINOIS PEST.

Mr. HENRY AUGUSTINE of Normal, Ills.: Has any one tried spraying for the "skeletonizer?"

No one knew of this pest in the state.

Mr. AUGUSTINE: There are three or four broods of the insect, and they eat all but the skeletons of the leaves. They are very destructive, therefore, to the foliage in both orchard and nursery. The insects look like leaf rollers, but swarm thickly and do disastrous work. Paris green does not affect them.

WHY OLD SHADE TREFS DIE.

Mr. RICE: Do what they will, in the city streets and parks, they can not save the native, original trees. The fallen leaves blow away because there is no undergrowth to stop them, and so the natural nutrition of the tree is gone, and cold winds sweep through to the injury of the unprotected trunks. Besides, the earth is tamped down hard, allowing frost to penetrate further.

Mr. Tracy: The original growth may be replaced, for young trees of the same species are planted and flourish. I believe even the old ones may be preserved by proper care.

Mr. Rice: Young trees will strike their roots deeper than did the original trees, which mainly fed at or near the surface. They accommodate themselves to the changed conditions in ways the old trees can not do. An old oak can not bear civilization, but we all know how young oaks flourish everywhere.

PLUMS FOR A COMMERCIAL ORCHARD.

Mr. Graham asked what varieties of plum should be placed in a commercial orchard.

Mr. Sessions: I change my mind on this question every year. I like now many of the Damsons, and would set the German Prune; late varieties are preferable; I would plant many kinds, so as to have a succession, but no Japanese varieties, nor Wild Goose; I would have some yellow sorts.

Mr. Kellogg: There is most money in Lombard, Bradshaw, Coe's Golden Drop; from all others I get only a few fruits instead of a full, paying crop.

All agreed that the Wild Goose and its kind are not desirable for Michigan.

COLD STORAGE OF APPLES.

Through the secretary, Mr. S. B. Smith of Grand Rapids asked these questions:

What is the best method of storing from 5,000 to 10,000 bushels of apples? What is the best method of cold storage for a fruitgrower who has a crop of from 3,000 to 6,000 bushels of winter apples?

Mr. Morrill: Better store apples close to the market where they are to be sold and consumed, for when they are taken out of cold storage they must be used very quickly or they decay. So, cold storage on the farm is not practicable, as a rule. Better send to the large storage houses in Chicago, if that is the market, where there are ample and perfect facilities for keeping and handling the fruit to best advantage.

Mr. Slayton: Mr. Smith puts his apples into bins in the basement of his barn, five or six feet deep, and sorts and sells them in the spring. He has grown mostly Ben Davis, but is now grafting to other varieties.

Mr. Kellogg: The Ben Davis is about as good as cork soup, now; but it is a spring apple, is pretty good then when there are no other apples.

Mr. H. H. Hayes: Mr. Smith lately sold 2,000 bushels of Ben Davis for 50 cents per bushel.

Mr. Augustine: I agree that the Ben Davis of this state is not a good apple. Neither is it good in my own state, north of Decatur—is not fit to eat; but south of that point it is good. I know of a man who is planting 50,000 apple trees, and 40,000 of them are Ben Davis. I am pleased to learn of the success of the peach, here in Michigan, for it is constantly successful nowhere else. There is a strip of country through Indiana, Illinois, and Missouri, 100 to 150 miles wide, which is a good apple region. There is a much smaller strip in Illinois which once grew peaches, but will not do so now. I do not believe you can ever overdo the growing of peaches in Michigan.

FRUITS AND VEGETABLES OUT OF SEASON.

Mr. Tracy: A man goes from Michigan to Florida and plants tomatoes, for instance. By February or March he picks them, just before they turn red, and sends them north. A lady buys a few, at a high price, and finds them not good. A few weeks later she tries again, but fewer are eaten and no more bought. She concludes that the family do not like tomatoes; and so, when the Michigan tomatoes comes, she, and others like her, do not buy them, and the market for the home product is injured and the fruit sells too low. Out-of-season fruits and vegetables not only cut the prices of the home-grown product, but they spoil the liking and desire for it. Another evil in our marketing of fruits is that ninety per cent. of the price paid by the consumer goes to parties between the producer and consumer.

PLANT FOR QUALITY.

Mr. Garfield: A word is due in behalf of Mr. Lyon, for his persistent advocacy of low heads for fruit trees, a principle now universally adopted in Illinois and Missouri, as well as quite generally in our own state. And he has "fought, bled, and died," almost, for better quality in fruit, discouraging the planting of inferior kinds on the excuse that they would give a greater yield. I am sorry to see these immense orchards of Ben Davis in the country (Mr. Augustine has an orchard of 20,000 apple trees, mostly Ben Davis), for, so long as we raise and offer such fruits, so long will great shiploads of oranges and bananas and other fruits be sent in because our fruits are so poor in quality.

HOW TO PACK PEACHES AND BEAT CALIFORNIA.

Mr. Morrill: We need not fear the competition of California, if we send to market our good fruit in proper shape. Last year I beat the price of California peaches, both white and yellow, sending my largest and best fruits in flat boxes (the southern tomato packages). I did this for dollars, and found it paid first-rate. The fruit was not wrapped, nor was tarletan used, but every peach was in sight and sixty to sixty-eight peaches filled each twenty-pound box. I received $1.75 to $2 for Lewis, in packages which cost fourteen cents each. I sold my culls at the packing-house, for fifty cents per bushel, and there was demand for all I could furnish. It was dollars in my pocket, not to send them to the Chicago market. My seconds were sent in half-bushel baskets. I picked ripe fruit and sent it to St. Cloud, Minn., all right, but it was not pinched nor squeezed, and it reached the consumer without harm. My lowest sales of such fruit was at $1.50 per box and from that up to $2. There was not a day but I got double the California price.

Several other members spoke in behalf of better methods of packing of fruits, some reciting experience which confirmed Mr. Morrill's, and the general sentiment was favorable to reform in this particular.

ANNUAL REPORT OF SECRETARY.

Allegan, *Mich., Dec. 24, 1894.*

Gentlemen of the State Horticultural Society:

The close of this year finds our society in circumstances in most respects pleasant to contemplate and affording strong hope for future usefulness and success. Our auxiliary membership has been augmented by the formation of four local societies during the year, those at Charlotte, Covert, Ionia, and Saranac. In three of these the membership equals or exceeds forty each, and they seem to be full of zeal in their work. Including these, there are 18 local or district societies in the state which have held meetings more or less frequently through the year. The Sanilac and Port Huron societies appear to be defunct or nearly so.

The receipts and disbursements of the year have been as follows:

Annual memberships	$10 00
Auxiliary societies	82 82
Interest on life membership fund	143 77
Balance from last year	44 26
	$280 85

The expenditures are classified thus:

For secretary	$50 00
Expense of quarterly meetings	3 20
Expenses of library	26 57
Expenses of secretary's office	75 00
Items in treasurer's report	21 75
Balance on hand	104 33
	$280 85

Respectfully,

E. C. Reid,
Secretary.

REPORT ON FRUIT AND FLOWERS.

Your committee on fruit and flowers shown, would report that they find on the tables four collections of apples, exhibited by Saranac Horticultural society, 14 varieties; E. C. Phillips, 12 varieties; W. B. Andruss, 13 varieties; S. B. Smith, 15 varieties. All contain varieties of merit, but, as they are unusually free from scab and insect injuries, and are well handled, we award the premium of $10 in nursery stock, offered by the West Michigan Nurseries, to E. C. Phillips of Grand Rapids, for the following varieties: Shiawassee, King, Hubbardston, Jonathan, Red Canada, Wagener, Baldwin, Grimes, R. I. Greening, Northern Spy, Ben Davis, Talman.

We also find a few scattering pears and several varieties of apple without name.

There is also a jar of cranberries grown by D. C. Leach, Walton, and exhibited by Wesley Johnson.

There is also a collection of flowers from the Agricultural college greenhouse, including orchids, cannas, Poinsettia, and clerodendron.

The ladies of Lowell have also taken great pains to decorate the room with evergreens and bunting, for which they have the thanks of the society.

L. R. Taft,
T. T. Lyon,
A. S. Packard.

REPORT ON IMPLEMENTS.

Your committee would report that they found on exhibition by Morrill & Morley of Benton Harbor, the Eclipse spray pump, both complete and in its separate parts. This pump embodies principles of construction aimed at securing greater efficiency and durability, which make it worthy of the most careful examination of any one who contemplates using such an implement. They also exhibit an automatic spraying outfit which seems to be valuable as a labor-saving device; and lastly, they show a full line of spraying nozzles.

We think the thanks of the society are due to these gentlemen for making such a full and complete exhibit, particularly as we feel certain that often so-called spraying proves valueless through the inefficiency of the apparatus used.

The committee understand that nothing but unexpected delay in the delivery of freight prevented the exhibition by J. A. Pearce of Grand Rapids, of the spraying out-outfit made by the Bean-Chamberlain Co.

The committee also found on exhibition by R. M. Kellogg, a machine for cutting runners and one for forming a properly shaped hole, having a cone of earth in the center, for the setting of strawberry plants. They are both ingenious and worthy of attention of every strawberry culturist.

Thomas Wilde,
C. J. Monroe,
W. W. Tracy.

RESOLUTIONS.

The Michigan State Horticultural society, in annual session at the village of Lowell, near the close of 1894, desires to place on record its appreciation of the many courtesies extended to its membership by the local society and friends of horticulture during a very interesting and successful meeting. Everything has been done for us that genuine hospitality could suggest for our comfort and happiness; and the interest manifested in the object of our society is assurance that our local branch at this place will be a strong ally in the accomplishment of the purposes of our organization.

Upon matters referred to our committee, we recommend the adoption of the following:

Resolved, That the Michigan Horticultural society is in sympathy with any movement among commission men which looks toward a better understanding between grower and dealer, and which has for its object the well-being and the well-doing of both classes, recognizing that sterling honesty on the part of either class should be the basis of any method or arrangement.

Resolved, That this society favors the utilization of lands in our state, not adapted to the purposes of successful agriculture, for the growing of timber, and earnestly commend to the farmers the planting of the less fertile or waste portions of their farms to forest trees; and, in recognition of the general effects for the state of increased plantations of timber, we urge upon our legislature a careful consideration of the problems connected with reforestation and the preservation of a proper portion of our land area in timber, and the enactment of practical legislation that shall stimulate our people to act as well as talk in this matter.

Resolved, That we earnestly and aggressively commend the bill now pending in congress, which provides for the protection of our natural preserves through the aid of the military department of government, and we urge the prompt passage of the bill, as delays are dangerous when thieves are actually at work despoiling these valuable properties.

Resolved, That we are cordially in favor of giving state aid freely to the dissemination of valuable information to the people through farmers' institutes, and we are not unmindful that Michigan might well recognize, by small annual appropriations, the work of our own society, inasmuch as it requires of us for publication an annual report, which for years has been made a power for good in developing our horticultural resources and advertising our special adaptability to the growth of a very wide range of horticultural products.

Resolved, That a legislative committee should be named at once, of which the president of the society shall be chairman, and that such committee are hereby authorized and instructed to use all honorable means to secure legislative recognition of the valued work of this society in the development of our resources, by giving to it annual financial aid.

Resolved, That the movement instituted some years ago by this society, and warmly seconded by D. M. Ferry & Co., looking toward a more general dissemination of practical information in the cultivation of flowers by awakening interest in the embelishment of the rural school grounds, has been productive of much good and is worthy of a still more persistent and extended effort, and we urge the officers of the society to again take up the matter and, if possible, secure once more the aid of D. M. Ferry & Co., in awakening an interest in embelishment of school premises by teachers and children, and the utilizing of this object lesson in giving simple lessons in horticulture of value to every home in the land.

CHAS. W. GARFIELD,
D. W. WILEY,
R. M. KELLOGG.

Prof. L. R. TAFT offered the following preamble and resolution, which were adopted:

WHEREAS, The American Pomological society has, since its organization, been engaged in the onerous task of bringing order out of the confusion so long existing in the nomenclature and general literature of our pomology, a work necessarily limited by the fact of its volunteer and periodical character; and

WHEREAS, The national government has, through its department of agriculture, devised a division of pomology to meet the increasing modern requirement of this branch of our national interest, in its more modern commercial phase, which division has adopted the "Rules of Pomology" of said society as the basis of its action; and

WHEREAS, Under these circumstances it is clearly of the utmost importance that the action of the two be in entire harmony; therefore

Resolved, That the Michigan State Horticultural society view with great satisfaction the proposal to devise a plan to insure such concerted action between the two, looking to the purifying of our present pomological nomenclature, the elimination therefrom, so far as practicable, of the crudities as well as the worthless matter which now cumbers its literature and its catalogues.

Resolved, That this society further commends the effort to devise a plan through which to secure the suppression of the modern practice of practicing upon the credulity of the public, for individual profit, by the introduction of novelties of questionable value, and by the re-introduction of the old varieties under new names.

LAWS OF MICHIGAN RELATING TO HORTICULTURE.

YELLOWS AND BLACK KNOT.

AN ACT to prevent the spread of the contagious diseases known as yellows, black knot, peach rosette, and pear blight among peach, plum, cherry, prune, almond, apricot, nectarine, and pear trees, or the fruit thereof, by providing measures for the eradication of the same, and to repeal act number one hundred twelve of the public acts of eighteen hundred ninety-three, approved May twenty-fifth, eighteen hundred ninety-three.

SECTION 1. *The People of the State of Michigan enact,* That it shall be unlawful for any person to keep any peach, almond, apricot, plum, prune, cherry, nectarine or pear tree infected with the contagious diseases known as yellows, black knot, peach rosette, or pear blight, or to offer for sale or shipment or to sell, or to ship any of the fruit thereof, except the fruit of the plum, cherry, and pear tree; that both tree and fruit so infected shall be subject to destruction as public nuisances as hereinafter provided. No damages shall be awarded in any court in the state for entering upon the premises and destroying such diseased trees or parts of trees or fruit if done in accordance with the provisions of this act. It shall be the duty of every person as soon as he becomes aware of the existence of such disease in any tree, parts of trees, or fruit owned by him, to forthwith destroy, or cause said trees or fruit to be destroyed.

SEC. 2. In any township or city in this state in which such contagious diseases exist or in which there is good reason to believe they exist or danger may be justly apprehended of their introduction, it shall be the duty of the township board or city council as soon as such information becomes known to either such board or council or any member thereof, to appoint forthwith three competent freeholders of said township or city, as commissioners, to be known as yellows commissioners, who shall hold office during the pleasure of said board, or city council, and such order of appointment and of revocation shall be entered at large upon the township or city records: *Provided,* That the commissioners now appointed and in office shall continue in said office until their successors are appointed and qualified: *Provided,* That in case commissioners have already been appointed to prevent the spreading of bush, vine, and fruit tree pests, such commissioners shall be *ex officio* commissioners under this act.

SEC. 3. It shall be the duty of said commissioners, within ten days after appointment as aforesaid, to file their acceptances of the same with

the clerk of said township, or city, and said clerk shall be *ex officio* clerk of said board of commissioners, and he shall keep a correct record of the proceedings of said board in a book to be provided for the purpose, and shall file and preserve all papers pertaining to the duties and actions of said commissioners, or either of them, which shall be a part of the records of said township or city.

SEC. 4. It shall be the duty of the commissioners, or any one of them, upon, or without complaint, whenever it comes to their notice that either of the diseases known as yellows, black knot, peach rosette or pear blight exist, or are supposed to exist within the limits of their township, village or city, to proceed without delay to examine the tree or fruit supposed to be infected, and if the disease is found to exist, a distinguishing mark shall be placed upon the diseased trees, and the owners notified personally or by a written notice left at his usual place of residence, or if the owner be a non-resident, by leaving the notice with the person in charge of the trees or fruit, or the person in whose possession said trees or fruit may be. The notice shall contain a simple statement of the facts as found to exist, with an order to effectually uproot and destroy, by fire or as the commissioner shall order, the trees so marked or designated, or such parts thereof, within five days, Sundays excepted, from the date of the service of the notice, and in case of fruit so infected, such notice shall require the person in whose possession or control it is found to immediately destroy the same, or cause it to be done, or the commissioner may destroy the same. Said notice and order to be signed by one or more of the commissioners.

SEC. 5. In case any person who is interested in any tree or trees so ordered to be destroyed shall feel aggrieved by such order and shall believe that such trees are not so diseased, he may serve a written notice upon all of the commissioners in the township in which such trees are situated, which notice shall specify the part of such order to which objection is made and the particular tree or trees included in such order which it is claimed are not so diseased and shall request an examination of such tree or trees by all of said commissioners, which notice shall be served personally upon each of said commissioners within the five days given for the destruction of said trees, and it shall thereupon be the duty of all said commissioners who have not already done so to personally examine such tree or trees as soon as practicable and within said five days, and if a majority of all the commissioners shall agree that such tree or trees are so diseased, they shall order the same to be destroyed forthwith by the owner or custodian thereof; but if a majority shall decide that such tree or trees, or any of them are not so diseased, they shall revoke the order of the commissioner to destroy the same as far as it relates to the trees so found to be free from disease, but this section shall not apply to fruit ordered to be destroyed.

SEC. 6. Whenever any person shall refuse or neglect to comply with the order to remove and destroy the trees or parts of trees so designated and marked by the commissioner as aforesaid, it shall become the duty of the commissioner to cause said trees or parts of trees to be removed and destroyed forthwith, employing all necessary aid for that purpose. The expenses for such removal and destruction of trees or parts of trees to be a charge against the township or city, and for the purpose of such removal or destruction the said commissioners, their agents and workmen shall have the right and power to enter upon any and all premises within their township or city.

SEC. 7. If any owner neglects to uproot and destroy, or cause to be removed and destroyed as aforesaid, such diseased trees, or parts of trees or fruit, after such examination and notification, and within the time hereinbefore specified, or any other person who shall sell or offer for sale such diseased fruit, such person shall be deemed guilty of a misdemeanor, and punished by a fine not exeeding one hundred dollars, or by imprisonment in the county jail not exceeding three months, or both, in the discretion of the court, and any justice of the peace of the township or city where such trees may be, or where such nursery stock or fruit is sold, shipped, disposed of, or delivered as aforesaid, shall have jurisdiction thereof. The words "parts of trees" wherever used in this act, shall refer to black knot and pear blight only, and not to trees affected with yellows.

SEC. 8. The commissioners shall be allowed for services under this act two dollars for each full day, and one dollar for each half day, and their other charges and disbursements hereunder, to be audited, as well as any other charges and disbursements under this act, by the township board, or city council, all of which costs, charges, expenses and disbursements may be recovered by the township, or city from the owner of such diseased fruit or nursery stock, or from the owner of the premises on which said diseased trees stood, in action of assumpsit: *Provided,* Said owner has refused or neglected to remove said diseased fruit or nursery stock in compliance with the order of said commissioner or commissioners.

SEC. 9. All of act number one hundred and twelve of the public acts of eighteen hundred and ninety-three be and the same is hereby repealed.

This act is ordered to take immediate effect.

Approved May 4, 1895.

SPRAYING.

AN ACT to prevent the spreading of bush, vine, and fruit tree pests, such as canker-worms and other insects, and fungus and contagious diseases, and to provide for their extirpation.

SECTION 1. *The People of the State of Michigan enact,* That it shall be the duty of every owner, possessor, or occupier of an orchard, nursery, or vineyard, or of land where fruit trees or vines are grown, within this state, to spray with a poisonous solution or disinfectant, of sufficient strength to destroy such injurious insects or contagious diseases, all fruit trees or vines grown on such lands which may be infested with any injurious insects or worms, or infected with any contagious disease known to be injurious to fruit or fruit trees or vines: *Provided,* That no such spraying shall be done while said fruit trees or vines are in blossom, except in case of canker-worms.

SEC. 2. In any township in this state where such injurious insects or contagious diseases are known to exist, or in which there is good reason to believe they exist, or danger may be justly apprehended of their introduction, it shall be the duty of the township board, upon the petition of at least ten freeholders of such township, to appoint forthwith three competent freeholders of said township as commissioners, who shall hold office during the pleasure of the board, and such order of appointment and of

revocation shall be entered at large upon the township record: *Provided*, That in townships having a board of yellows commissioners, such commissioners shall be *ex officio* commissioners under this act.

SEC. 3. It shall be the duty of said commissioners, within ten days after appointment, as aforesaid, to file their acceptance of the same with the clerk of said township, and said clerk shall be *ex officio* clerk of said board of commissioners, and he shall keep a correct record of the proceedings of said board, in a book to be provided for that purpose, and shall file and preserve all papers pertaining to the duties and actions of said commissioners, or either of them, which shall be a part of the records of said townships.

SEC. 4. It shall be the duty of said commissioners, or any one of them, upon, or without, complaint, whenever it comes to their notice, that any orchard, fruit trees, or vines are infested with canker-worm or other injurious insects or contagious disease, within their townships, to proceed without delay to examine such orchards or vineyards supposed to be infested, and if such injurious insects or contagious diseases are found to exist, the owner shall be notified personally, or by a written notice left at his usual place of residence; or if the owner be a non-resident, by leaving the notice with the person in charge of the trees or vines, or the occupant of the lands upon which such trees or vines shall be growing. The notice shall contain a simple statement of the facts as found to exist, with an order to effectually destroy such injurious insects or worms or contagious disease by spraying such trees or vines with a poisonous solution, or, in case of contagious disease, to effectually disinfect said diseased trees or vines, within such time from the date of the service of the notice as such commissioners shall designate, said notice and order to be signed by the full board of commissioners.

SEC. 5. Whenever any person shall refuse or neglect to comply with the order to spray or disinfect the orchards or vineyard designated by the commissioners, as aforesaid, it shall become the duty of the commissioners to cause said trees or vines to be effectually sprayed with a poisonous solution, or disinfected, as occasion should require, forthwith, employing all necessary aid for that purpose, and the expenses for the same shall be a charge against the township; and for said spraying or disinfecting, the said commissioners, their agents or workmen, shall have the right and power to enter upon any and all premises within their township.

SEC. 6. If any owner, township officer, or commissioner, neglects or refuses to comply with the requirements of this law as set forth in the preceding sections, and within the time therein specified, such persons shall be deemed guilty of a misdemeanor, and punished by fine not exceeding fifty dollars or imprisonment in the county jail not exceeding sixty days, or by both such fine and imprisonment, in the discretion of the court; and any justice of the peace of the township where such trees or vines may be growing shall have jurisdiction thereof.

SEC. 7. The several commissioners shall be allowed for service under this act, two dollars for each full day, and one dollar for each half day, and their other charges and disbursements hereunder, to be audited, as well as any other charges and disbursements under this act, by the township board, all of which costs, charges, expense, and disbursements shall be recovered by the township from the owner of said infected or infested orchards or vineyards, from the owner of the premises on which said trees

or vines may be growing, in an action of assumpsit. The provisions of this act shall not apply to the contagious disease known as yellows.

This act is ordered to take immediate effect.

Approved May 4, 1895.

PILFERING FROM ORCHARDS.

AN ACT to protect vineyards, orchards, and gardens, and to repeal act number 131, public acts of 1869, entitled "An act to protect vineyards in the state of Michigan," being section 9195 of Howell's annotated statutes.

SECTION 1. *The People of the State of Michigan enact,* That any person who shall enter a vineyard, orchard, or garden, during the months of July, August, September or October, without the consent of the owner, and pick, take, carry away, destroy, or injure any of the fruits, vegetables, or crops therein, or in anywise injure or destroy any bush, tree, vine, or plant, shall be guilty of a misdemeanor, and on conviction thereof shall be punished by imprisonment in county jail, not more than ninety days, or by fine not less than five nor more than one hundred dollars, or by both such fine and imprisonment in the discretion of the court.

SEC. 2. That act number 131 of the public acts of 1869, entitled "An act to protect vineyards in the state of Michigan," being section 9195 of Howell's annotated statutes of Michigan, be and the same is hereby repealed.

Approved April 17, 1895.

MARKING FRUIT PACKAGES.

AN ACT to provide for marking on packages, designed for the shipment of certain specified kinds of fruit, the number of pounds which each of said packages shall contain.

SECTION 1. *The People of the State of Michigan enact,* That all manufacturers of peach baskets and other fruit packages designed for the shipment of peaches, grapes, and plums, and all shippers and dealers in the same, shall mark or cause to be marked, in a plain manner, on the outside, otherwise than the bottom, of such baskets or packages, the capacity of each basket or package, in pounds, at the rate of one pound for each 43.008 cubic inches of space contained in such basket or package.

SEC. 2. Any manufacturer of or dealer in peach baskets or other fruit packages designed for the shipment of peaches, grapes, and plums, who shall sell or offer to sell such baskets or packages without complying with the provisions of this act, shall be deemed guilty of misdemeanor, and upon conviction thereof in any court of competent jurisdiction, shall be fined not less than twenty-five dollars nor more than one hundred dollars, and stand committed to the county jail until such fine and costs are paid.

SEC. 3. All acts or parts of acts contravening the provisions of this act are hereby repealed.

This act is ordered to take effect January 1, 1896.

Approved May 31, 1895.

BULLETINS

OF THE

AGRICULTURAL EXPERIMENT STATION

OF

MICHIGAN

STATE EXPERIMENT STATION BULLETINS.

FRUITS AT THE SUB-STATION.

BY T. T. LYON.

Bulletin No. 118.

To Professor L. R. Taft, Horticulturist:

SIR—I herewith respectfully submit my report of operations, for the season of 1894, at the South Haven sub-station, considering the several classes of fruits, as nearly as practicable, in the order of their maturity.

The grapes were sprayed last autumn after the dropping of the foliage and the completion of the pruning, using Bordeaux mixture of the usual strength; prior to the commencement of growth the past spring, the entire plantation received a spray consisting of one pound of copper sulphate dissolved in twenty-five gallons of water.

Subsequent sprayings were given, which will be noticed in connection with the several species of fruits to which they were applied, as will also the depredations of insects and fungi, and the remedies therefor.

NOMENCLATURE.

The "Rules of Pomology" of the time-honored American Pomological society have been adopted as its rule of action, in matters of nomenclature, by the National Division of Pomology, which, as may not be generally understood, is also engaged in the endeavor to renovate, simplify, and purify the crudities of our nomenclature of American fruits. Such being the condition of affairs, it seems eminently wise and appropriate that such rules be generally recognized and applied. Such application is accordingly made, so far as the nomenclature of fruits in this report may be concerned.

STRAWBERRIES (*Fragaria*).

The plat of this fruit represented in this record, having been planted in the spring of 1893, was more or less retarded in growth by the protracted drouth of the following summer, although by the frequent stirring of the soil and the thorough eradication of weeds the soil was kept in porous condition, and steady growth maintained.

As in previous plats, two dozen plants only, of each variety, were grown, of which one dozen were kept in hills, by the persistent removal of the runners, while the remaining dozen were allowed to form a narrow matted row. The product of each dozen was gathered and recorded separately, for the purpose of determining their comparative productiveness.

The plants having been mulched during the past winter, the mulch was removed in early spring, and the spaces between rows given shallow culture and kept free from weeds. The result was an eminently satisfactory show of fruit, at the season of ripening, in June last.

Unfortunately, soon after ripening had commenced, a season of unusually hot, drying weather set in, which soon began to tell upon the yet immature fruit, while the constant tramping of pickers, as well as of the numerous visitors, compacted and hardened the previously mellow surface, with the result that, from one or both causes, a large percentage (probably fully one half) of the prospective crop failed to mature. Possibly such result might have been partially averted by continuing cultivation during the season of ripening, though more or less to the inconvenience of employes and visitors, but beyond doubt the more effective remedy would have been irrigation—for resort to which, however, appliances were not at hand.

Whether due to the early spraying, or to climatic or other causes, there have been few if any depredations of either insect or fungi demanding preventive or repressive applications during the growing season. After the close of the fruiting season, a spray of Bordeaux was applied, to insure healthy subsequent growth, it being proposed to continue the plat another season for the purpose of comparing a second crop from this, with a first crop from a similar plat planted last spring.

In the following tabulated list of strawberries, descriptions of varieties being, in such case, unavoidably brief and imperfect, are omitted, excepting only vigor of plant, size, productiveness, and firmness, which are expressed upon the scale, 1 to 10; which scale is applied in the case of all the *small fruits*, 10 representing the highest grade and 1 the lowest.

TABULATED LIST OF STRAWBERRIES—1894.

Number.	Name.	b—bisexual. n—nearly. p—pistillate.	When received.	First bloom.	First picking.	Last picking.	In ounces. Produced in hills.	Produced in matted row.	Vigor, 1-10.	Size, 1-10.	Firmness, 1-10.	Remarks.
1	Afton	p	1892	May 4	June 15	July 2	51	66	5	5	9	
2	Alpha	b	1881	April 28	June 15	June 29	58	78	7	4	9	One of the earliest.
3	Auburn	p	1892	May 11	June 18	July 2	21	46	5	4	5	
4	Augwick	p	1892	May 8	June 18	July 2	25	45	7	6	8	New; promising.
5	Australian	b	1892	May 4	June 18	July 2	18	27	3	6	5	A thin stand of plants.
6	Banquet	p	1892	May 3	June 15	July 2	48	58	4	3	6	A dessert variety.
7	Barton	p	1891	May 6	June 18	July 2	23	48	7	6	7	Not a full stand.
8	Beauty	b	1892	May 3	June 18	July 2	16	70	8	5	5	
9	Beder Wood	b	1890	April 30	June 15	July 2	76	117	9	6	7	Sent out as Racster.
10	Belt 3	b	1892	May 7	June 18	July 4	45	92	10	10	6	Flavor mild.
11	Bessie	p	1890	May 1	June 15	June 29	13	27	8	3	7	Stand quite defective.
12	Beverly	b	1892	May 8	June 15	July 5	31	38	5	5	7	Stand not full.
13	Brandywine	b	1892	May 10	June 21	July 5	7	37	10	6	8	Promising.
14	Brunette	b	1892	May 10	June 18	July 2	31	68	8	7	6	
15	Boynton	p	1891	May 8	June 15	July 2	109	169	9	3	6	
16	Bubach 5	p	1888	May 9	June 15	July 2	76	138	9	8	7	Showy; market.
17	Bubach 24	b	1890	May 8	June 15	June 27	23	26	8	4	6	
18	Bubach 137	b	1890	May 7	June 15	July 2	36	55	10	5	6	
19	Cameronian	b	1892	May 4	June 18	July 2	24	54	8	5	6	
20	Chairs	p	1893	May 9	June 15	July 2	94	81	9	5	5	
21	Childs	b	1893	May 7	June 15	July 2	25	88	10	8	9	Imperfect stand.
22	Cleveland	p	1888	May 10	June 15	July 2	62	54	8	6	5	Mrs. Cleveland.
23	Consensus	p	1893	May 15	June 21	July 5	22	31	9	10	8	New; promising.
24	Copernicus	p	1893	May 14	June 18	July 2	61	28	9	9	5	New; promising.
25	Crawford	b	1889	May 11	June 18	July 5	47	72	7	7	8	

STRAWBERRIES.—Continued.

Number.	Name.	b—bisexual. n—nearly. p—pistillate.	When received.	First bloom.	First picking.	Last picking.	In ounces. Produced in hills.	In ounces. Produced in matted row.	Vigor of plant, 1-10.	Size, 1-10.	Firmness, 1-10.	Remarks.
26	Crescent	p	1888	May 8	June 15	July 5	127	111	9	5	6	Lacks color and firmness.
27	Cumberland	b	1888	May 11	June 18	July 5	20	21	9	10	5	Lacks color and firmness.
28	Curtis 15	b	1892	May 8	June 15	July 2	47	75	9	4	3	Poor in quality.
29	Curtis 159	p	1892	May 14	June 18	July 2	100	110	10	8	8	
30	Daisy	p	1890	May 9	June 15	July 2	49	65	8	5	6	Stand imperfect.
31	Dayton	b	1892	May 9	June 15	June 29	29	48	9	8	4	
32	Dutter	b	1889	May 12	June 18	July 2	57	64	7	9	9	
33	Edgar	p	1890	May 14	June 18	July 5	78	145	9	10	4	Good market variety.
34	Edwards	b	1891	May 14	June 21	July 5	33	61	5	5	7	
35	Engle 1	b	1890	May 1	June 18	July 5	48	97	7	8	5	Not productive enough.
36	Enhance	b	1890	May 8	June 18	July 5	65	124	6	7	10	A good pollenizer.
37	Estelle	b	1891	May 2	June 18	July 5	60	38	5	10	10	A dessert variety.
38	Eureka	p	1888	May 8	June 18	July 5	69	78	8	7	8	Market.
39	Fairmount	b	1891	May 7	June 15	July 5	63	95	9	5	5	
40	Farnsworth	b	1891	May 5	June 15	July 5	54	98	7	6	5	
41	Felton	b	1890	May 10	June 18	July 2	66	92	10	9	7	Dessert.
42	Florence	b	1888	May 11	June 18	July 5	35	51	6	8	8	Stand not full.
43	Gandy	b	1887	May 14	June 18	July 2	17	55	9	8	9	A late variety.
44	Gem (Nehring)	p	1890	May 14	June 18	July 5	33	84	8	7	5	
45	Gillespie	b	1891	May 8	June 15	July 2	22	56	4	7	9	
46	Gould	p	1892	May 14	June 15	July 5	28	54	8	4	7	Not a full stand.
47	Greeneville	p	1891	May 11	June 18	July 5	78	135	8	6	5	Promising.
48	Hampden	p	1889	May 10	June 18	July 5	47	125	3	5	10	
49	Hattie	p	1891	May 10	June 18	July 5	134	93	9	5	6	
50	Haverland	p	1887	May 1	June 15	July 5	73	108	6	7	9	Prized for the market.
51	Hermit	b	1892	May 7	June 18	July 5	84	142	10	5	8	
52	Hinman	b	1890	May 12	June 18	July 5	92	97	9	7	8	
53	Hoard	b	1888	May 2	June 15	July 2	55	80	7	6	9	Stand not full.
54	Holyoke	b	1891	May 3	June 15	July 2	66	83	8	6	9	Stand imperfect.
55	Howard	p	1892	May 7	June 15	July 2	63	117	9	3	9	
56	Hugo	b	1891	April 30	June 15	July 2	54	64	6	7	7	Dessert, promising.
57	Huntsman	b	1892	May 10	June 15	July 2	59	55	10	4	8	
58	Iowa	b	1892	May 7	June 18	June 27	25	33	3	4	6	
59	Ivanhoe	b	1889	May 10	June 15	July 5	92	121	7	6	8	
60	Jessie	b	1889	May 8	June 18	July 2	63	81	7	7	7	
61	Katie	b	1892	May 8	June 15	July 5	59	79	9	8	5	Stand poor.
62	La Crosse	n p	1892	May 12	June 18	July 2	12	42	6	6	4	
63	Leader	b	1892	May 3	June 15	June 29	40	73	5	6	8	
64	Lehigh	p	1891	May 7	June 15	July 2	97	124	7	5	7	
65	Leroy	p	1892	May 8	June 15	July 5	145	96	7	4	5	
66	Leviathan	b	1892	May 12	June 18	July 2	46	52	8	6	9	Stand very imperfect.
67	Lida	p	1886	May 10	June 18	July 5	81	158	6	7	8	
68	Lincoln	p	1892	May 8	June 18	July 5	159	202	9	4	5	Promising.
69	Logan	b	1888	May 10	June 18	July 5	77	141	7	6	9	
70	Long John	b	1893	May 3	June 15	July 5	71	109	10	5	5	
71	Louise	b	1889	May 14	June 15	July 5	64	122	7	7	9	
72	Lovett	b	1891	May 7	June 15	July 2	86	106	5	5	8	Imperfect stand.
73	Manchester	p	1888	May 9	June 18	July 5	47	106	4	5	9	Inclined to overbear.
74	Mark	b	1890	May 12	June 18	July 5	30	79	10	5	10	Stand not full.
75	Martha	n p	1887	May 9	June 15	July 2	77	58	10	5	6	Stand not full.
76	Miami	n p	1889	May 10	June 18	July 2	41	87	6	4	5	
77	Michel	b	1890	April 30	June 15	June 25	40	36	9	5	10	Early; small.
78	Miller	b	1890	May 15	June 23	July 5	23	5	9	3	10	
79	Monarch	b	1892	May 12	June 21	July 5	34	69	9	6	8	
80	Monroe	b	1891	May 9	June 19	July 2	37	28	3	4	10	Stand poor.
81	Moore	b	1888	May 10	June 19	July 5	61	105	7	9	8	
82	Muskingum	b	1892	May 14	June 19	July 5	59	115	5	6	8	Promising.
83	Mystic	b	1892	May 8	June 19	July 5	35	28	6	5	7	
84	Neptune	p	1890	May 9	June 19	July 5	44	45	10	7	6	
85	No. 31	b	1892	May 12	June 21	July 5	12	50	10	8	8	

STRAWBERRIES.—CONCLUDED.

Number.	Name.	b—bisexual. n—nearly. p—pistillate.	When received.	First bloom.	First picking.	Last picking.	In ounces. Produced in hills.	In ounces. Produced in matted row.	Vigor of plant, 1-10.	Size, 1-10.	Firmness, 1-10.	Remarks.
86	Ohio Centennial	p	1891	May 10	June 19	July 5	61	102	8	8	6	
87	Oliver	b	1890	May 14	June 19	July 5	71	89	9	7	9	
88	Omega	p	1889	May 12	June 15	July 5	100	160	6	5	8	
89	Oregon	p	1891	May 9	June 15	July 5	73	95	5	6	6	
90	Osceola	b	1890	April 27	June 15	June 25	31	66	9	5	7	Same as Michel.
91	Pacific	p	1890	May 10	June 19	July 2	108	182	10	9	5	Flavor poor.
92	Parker Earle	b	1889	May 14	June 19	July 5	95	173	9	7	7	Desirable; from Texas.
93	Parry	b	1886	May 7	June 19	July 2	54	103	10	7	6	Large; good.
94	Pearl	b	1888	May 9	June 15	July 5	119	173	8	5	10	Southern.
95	Porter	b	1890	May 5	June 15	July 2	43	53	4	4	10	
96	Price	b	1892	May 9	June 15	July 2	58	62	9	5	10	
97	Princess	p	1892	May 8	June 15	June 29	67	102	8	5	3	
98	Puritan	b	1887	May 3	June 15	July 2	49	72	7	9	5	
99	Putnam	b	1890	May 3	June 21	July 2	91	157	9	10	5	Flavor poor.
100	Riehl 6	b	1893	April 27	June 15	July 2	58	20	5	5	10	Stand imperfect.
101	Rio Vista	p	1891	April 30	June 15	June 25	22	70	9	4	8	Is Thompson 9.
102	Roe	b	1891	May 12	June 22	July 5	21	28	9	6	5	Named for E. P. Roe.
103	Rusk	p	1889	May 12	June 19	July 5	69	115	9	5	8	
104	Sadie	p	1890	May 7	June 15	July 5	102	175	7	5	7	
105	Sandoval	b	1890	May 3	June 15	July 5	90	104	9	5	9	
106	Saunders	b	1889	May 15	June 19	July 5	101	169	8	6	9	From Ontario.
107	Scarlet Ball	b	1892	May 16	June 23	July 5	32	33	10	9	8	
108	Sharpless	b	1878	May 10	June 21	July 5	53	152	9	10	9	
109	Shaw	b	1890	May 10	June 19	July 5	66	91	6	7	6	
110	Shuster	b	1891	May 17	June 15	July 5	49	80	7	5	8	
111	Southard	b	1892	May 3	June 15	July 2	77	95	7	6	9	
112	Speece	b	1890	May 10	June 19	July 5	91	124	6	7	8	
113	Splendid	b	1892	May 8	June 15	July 2	42	36	10	5	8	Imperfect stand.
114	Standard	b	1892	May 8	June 15	July 2	25	62	7	4	7	Imperfect stand.
115	Stayman 1	p	1890	May 14	June 19	July 5	83	129	10	4	10	
116	Stayman 2	p	1890	May 2	June 15	July 5	72	141	10	6	8	
117	Stevens	b	1890	May 1	June 15	June 25	45	70	7	4	10	Southern.
118	Sucker State	b	1890	May 14	June 15	July 5	12	25	9	4	9	
119	Surprise	b	1892	May 4	June 19	July 2	55	68	6	6	8	
120	Swindle	p	1892	May 4	June 15	July 5	52	176	5	5	10	Uncertain value.
121	Thompson 5	b	1890	May 1	June 15	June 25	2	39	3	4	9	Stand imperfect.
122	Thompson 7	p	1890	May 9	June 15	June 30	52	138	8	5	7	Stand imperfect.
123	Thompson 8	p	1890	May 1	June 15	July 2	72	193	9	4	8	
124	Thompson 25	b	1890	May 7	June 15	July 2	25	65	9	5	6	Stand quite imperfect.
125	Thompson 26	p	1890	May 9	June 15	July 5	45	72	10	4	8	Deficient stand.
126	Thompson 31	p	1890	May 10	June 19	July 5	66	131	10	5	5	Stand not complete.
127	Thompson 34	p	1890	May 7	June 15	July 5	57	126	6	3	7	
128	Tippecanoe	b	1890	May 8	June 15	July 5	75	121	7	8	7	European.
129	Townsend 2	b	1888	May 12	June 12	July 5	34	50	6	7	9	
130	Townsend 3	p	1888	May 10	June 15	June 30	39	97	4	5	5	
131	Townsend 19	p	1888	May 5	June 15	July 5	88	205	10	5	8	
132	Townsend 20	p	1888	May 8	June 15	July 5	84	147	10	7	6	
133	Triomphe (de Gand)	b	1876	May 10	June 19	July 5	44	54	9	6	8	Old European.
134	Unnamed (Nehring)	b	1890	May 4	June 15	June 30	28	51	9	6	4	
135	Vernon	b	1877	May 9	June 15	July 5	52	94	10	9	7	(Mount Vernon.)
136	Vick	b	1878	May 10	June 15	July 5	52	103	9	5	6	Very hardy.
137	Viola	b	1890	May 10	June 19	July 5	34	64	7	5	8	Stand not full.
138	Waldron	p	1891	May 11	June 15	July 5	34	58	5	4	7	Not a fair trial.
139	Walton	p	1890	May 8	June 15	July 5	51	138	9	6	6	Stand imperfect.
140	Warfield	p	1890	May 8	June 15	July 2	73	97	8	5	8	Popular; market.
141	Westbrook	p	1891	May 7	June 15	June 28	16	59	4	6	8	
142	Weston	p	1891	May 14	June 19	July 5	57	76	5	6	6	From the northwest.
143	Williams	b	1892	May 11	June 15	July 5	32	107	4	6	9	Poor foliage.
144	Wilson	b	1876	May 3	June 15	June 30	57	104	8	5	10	An old favorite.
145	Woolverton	b	1891	May 14	June 19	July 2	67	135	8	8	4	Origin Ontario.
146	Yale	b	1890	May 10	June 19	July 5	30	30	8	7	7	Origin New England.

Soon after the commencement of the ripening season the weather suddenly changed from cool and comparatively moist to hot and dry. Occurring, as this did, when the ripening of the earlier varieties was already well advanced, the effect upon their productiveness was less perceptible than in the case of the later kinds, many of which were scarcely past their first pickings. For this reason the recorded product of more or less of the later varieties may fairly be assumed to be very considerably less than it would have been under more favorable conditions.

For this reason, as bearing upon the question of relative productiveness, and partially on account of the large number of varieties under consideration, the following notes are made as brief as practicable, little if any space being devoted to mere descriptions.

Alpha, bisexual, has been retained in the collection on account of its earliness, fair size, and fair quality as a berry for home use.

Augwick, pistillate, has not, so far, shown favorable results here, but more favorable results elsewhere appear to justify a further trial here.

Banquet, p., possesses valuable characteristics as a family berry, though not relatively profitable for the market.

Beder Wood, b., holds a high position as a productive variety and also as a pollenizer of pistillates.

Brandywine, b., is favorably reported elsewhere but needs further trial here.

Boynton, p., has done unusually well here this season.

Bubach, p. and Crescent, p., still stand at the front as market varieties, with Cleveland, p. in a somewhat questionable position in this respect.

Chairs, p., has vigor and productiveness, which adapt it to market purposes. Otherwise it can not be ranked above medium.

Consensus, p., and Copernicus, p., are very recent introductions, which promise well but require further trial.

Crawford, b., with us, fails to sustain the character given it by the introducer.

Curtis 159, p., is but partially tested, but gives indications of profitableness as a market variety.

Edgar, p., has more or less reputation as a market variety, which it promises to sustain.

Enhance, b., has won a high character as a market variety, and is also valued as a pollenizer.

Eureka, p., is by no means a new variety. It holds a somewhat doubtful position as a market variety.

Felton, b., is not new, but has, this season, given better results than heretofore.

Gandy, b., is an excellent late variety for the home plantation, though it has not proved relatively productive here.

Gould, p., is new and has been grown the past season under unfavorable conditions. It requires further trial.

Greenville, p, although promising here and commended elsewhere, needs further trial.

Haverland, p., has been long and favorably known as a valuable market variety and also as desirable for the home plantation.

Hermit, b., and Hinman, b., have both, this season, excelled their earlier performances.

Hoard, b., Holyoke, b., Howard, p., Hugo, b., and Huntsman, b., so far

at least as the current season is concerned, occupy a middle ground, between desirability and unprofitableness.

Ivanhoe, b., has this season quite outdone itself, so far as productiveness is concerned.

Jessie, b., is practically a failure here.

Katie, b., gives promise of value, though it requires further trial.

La Crosse, nearly pistillate, proves unsatisfactory this season, the stand of plants being imperfect.

Lehigh, p., and Leroy, p., are comparatively new, and promising for market.

Lida, p., set an enormous crop of large berries, but, as heretofore, it failed to fulfill the promise.

Lincoln, p., has, this season, proved to be the most productive variety in the entire collection.

Logan, b., still maintains a somewhat doubtful position among market varieties.

Long John, b., is a new Michigan candidate for popularity, originating with that careful experimenter, Thomas Wilde of Ottawa county. Though by no means favorably conditioned, it develops promising characteristics.

Louise, b., and Lovett, b., together with the old, well-known Manchester, p., seem to hold a doubtful position among recognized market varieties.

Martha, nearly pistillate, Moore, b., and Muskingum, b., scarcely rank as popular varieties, although the last, being comparatively new, may quite possibly yet acquire a valuable reputation.

Ohio Centennial, p., (an objectionably long name) and Oliver, b., both hold very doubtful positions as candidates for popular recognition. The latter yields better results this year than usual.

Omega, p., and also Oregon, p., have fairly outdone themselves this season. In this climate the latter gives no indication of its alleged everbearing tendencies.

Pacific, p., would perhaps justify the *Great*, originally prefixed to its name, so far as size and productiveness are concerned, though it is deficient in both quality and fineness of texture.

Parker Earle, b., still holds its well-earned standing as both a family and market variety. It holds its double name, in defiance of modern Procrustean tendencies, doubtless mainly as a matter of courtesy or deference to the wish of its noted and popular introducer.

Parry, b. Only a slight lack of vigor and productiveness can be supposed to stand in the way of placing this large and excellent variety in the front rank of both the family and market lists.

Pearl, b., although of southern origin, possesses unusually valuable characteristics as a market variety for the north.

Princess, p., though somewhat deficient in vigor and firmness, has both size and productiveness to commend it to popular favor.

Putnam, b., (omitting the General) is large and productive and will probably also serve as a pollenizer.

Rusk, p., is scarcely likely to win more than a local popularity.

Sadie, p., has quite outdone itself this season, so far as productiveness is concerned.

Sandoval, b., and Saunders, b., are both very productive. They also

possess other qualifications calculated to render them useful as market varieties, and probably also as pollenizers.

Sharpless, b. Only slightly deficient productiveness seems to prevent this variety from assuming a leading position, both as a family and market berry.

Shuster, b., is by no means up to the standard, although it appears to be popular at the east, where it originated.

Southard, b., is but partially tested here. So far, it gives indications of possible, perhaps probable, success.

Splendid, b., is not yet well tested. So far, it affords but slight indications of value.

Speece, b., Stayman 1, p., and Stayman 2, p., all from Kansas, are productive and promising, though, so far, scarcely up to modern requirements.

Swindle, p. This name may, very possibly, have been chosen *under the rule of contraries*, to aid sales. So far, there is too much apparent occasion to fear that it may be found appropriate to the case.

Thompson 31, p., and Thompson 34, p., have now been on trial here several years. They have this year done better than ever before, but will now be dropped.

Tippecanoe, b., has also exceeded itself this year, but is, even yet, lacking in productiveness.

Triomphe (de Gand), b., a very old European variety, is now nearly or quite out of use.

Townsend 19, p., and Townsend 20, p., are doing better this year than heretofore, the former especially so. If thought worthy to be disseminated, they should receive names.

Vernon (Mt. Vernon), b., once popular, is now nearly or quite superseded.

Vick, b., although hardy and vigorous, is rather deficient in size, and is now rarely planted.

Warfield, p., is too generally known and valued to require characterization. The plants should not be allowed to become crowded in the row.

Wilson, b., appears to be going out of use, and has been retained here mainly as a means of comparison. When allowed to fully ripen upon the plant, it has few, if any, superiors, so far as high quality is concerned. Its liability to disease of the foliage is the most serious fault, and this is readily held in check by the use of Bordeaux mixture.

RASPBERRIES (*Rubus*).

For the purpose of avoiding, so far as practicable, the intermixing of varieties, through the running together of suckers, the suckering raspberry plats have been planted alternately with non-suckering varieties and with blackberries.

Since the injury consequent upon the extremely wet spring of 1892, it has proved impossible to re-secure a sufficiently even stand of plants, of most varieties, to justify a statement of relative values based upon the amounts of fruit yielded by each plat. Estimates, based upon comparisons of the products of average plants, expressed upon the scale of one to ten, have therefore been resorted to.

The only insect depredations observed during the season have been those of the Leaf Miner (*Tischeria malifoliella*—Clemens)? (See

Saunders, page 114) which has been occasionally observed as an apparent estray from the adjacent blackberry foliage. Its attacks upon the raspberry foliage have been very limited.

The crumpling of the foliage of most varieties of *Idœus* and *strigosus*, which usually appears in summer, and often seriously affects the quality, especially of the later berries, is supposed to be the effect of a fungus. It has appeared as usual.

Anthracnose, although present, has not been especially troublesome, though enough so to prove the difficulty of its entire eradication, and possibly to indicate that a more intimate acquaintance with its life history may be needful to develop other and possibly more vulnerable points of attack.

The raspberries, in common with the entire plantation, were sprayed on March 15, before vegetation had commenced, with a solution of one pound of copper sulphate in 25 gallons of water. This was followed, on May 17, with a spray of Bordeaux mixture of the usual strength.

More or less uncertainty is found to exist, even among botanists, respecting the species to which several varieties of raspberry should be assigned, owing to alleged or suspected hybridization between species. Such uncertainty is indicated by an interrogation (?) and the variety is placed in the class apparently most nearly in accord with its characteristics.

1st. *R. Idœus.*—With alleged or supposed hybrids.

Number.	Name.	Origin.	Planted.	First bloom.	First ripe fruit.	Productiveness, scale 1 to 10.	Remarks.
1	Herstine	Penn.	1870	May 26	July 3	5	Plant not hardy.
2	Marlboro	N. Y.	1881	June 2	July 5	6	Market.
3	Thwack	N. Y.?	1872	June 4	July 6	1	Large, of low quality.

2d. *R. neglectus.*—Includes varieties by many assumed to be hybrids between *occidentalis* and other species.

Number.	Name.	Origin.	Planted.	First bloom.	First ripe fruit.	Productiveness, scale 1 to 10.	Remarks.
1	Cardinal (Greisa)	Kan.	1891	June 1	July 4	6	Increased by both tips and suckers.
2	Caroline	N. Y.	1877	June 1	July 4	10	Bright clear yellow.
3	Gladstone	Ohio	1891	June 2	July 5	10	Bears an autumn crop.
4	Muskingum	Ohio	1890	June 4	July 5	10	Fruit much like Shaffer.
5	Shaffer	N. Y.	1878	June 4	July 5	8	Color dark purple.

3d. *R. occidentalis.*—Black and yellow, tip rooting.

Number.	Name.	Origin.	Planted.	First bloom.	First ripe fruit.	Productiveness, scale 1 to 10.	Remarks.
1	Ada	Ohio	1890				A failure.
2	Amer. Everbearing	Ind.	1893				Not yet fruited.
3	Beebe	N. Y.?	1886	May 28	July 7	8	A yellow cap.
4	Canada	Ont.	1891	May 31	July 5	5	Not valuable here.
5	Carman	Conn.	1886	May 23	July 3	7	Not popular.
6	Centennial	Mo.	1886	May 29	July 2	10	Rarely planted.
7	Conrath	Mich.	1891	May 31	July 2	10	New; promising.
8	Cromwell	Conn.	1890	May 23	June 30	9	Similar to Souhegan.
9	Doolittle	N. Y.	1884	May 25	July 2	9	The first introduced.
10	Doomore	Ohio	1889	May 24	July 3	7	Of no value here.
11	Earhart	Ill.	1888	May 29	July 2	7	Bears an autumn crop.
12	Farnsworth	Ohio?	1892	May 31	July 5	10	Promising.
13	Green	N. Y.	1894				Not yet fruited.
14	Gregg	Ind.	1880	June 1	July 7	6	Market; not hardy.
15	Hathaway 1	Mich.	1892	May 23	July 11	3	Yet unnamed.
16	Hathaway 2	Mich.	1892	May 29	July 1	10	Unnamed.
17	Hilborn	Ont.	1890	May 26	July 6	7	Large; quality superior.
18	Hopkins	Mo.	1884	May 28	July 3	10	Profitable for market.
19	Idaho	Idaho	1890	May 28	July 9	3	Plants badly enfeebled.
20	Indiana	Ind.	1884	May 23	June 30	10	Good market variety.
21	Johnston	Ark.	1888	May 29	July 6	9	Seeds very large.
22	Kansas	Kan.	1890	June 1	July 4	9	Quite successful.
23	Lovett	Ohio	1892	May 29	July 4	9	Promising.
24	Mam. Cluster	Ind.	1878	June 2	July 6	6	Nearly superseded.
25	Mohler	Ohio	1893	May 29	July 4	10	Very promising.
26	Nemaha	Neb.	1888	June 4	July 5	1	Much like Gregg.
27	Ohio	Ohio?	1884	May 28	July 1	10	Quite too seedy.
28	Older	Iowa	1891	May 23	July 11	9	Not fully tested.
29	Palmer	Ohio	1890	May 23	June 29	10	Best early.
30	Pioneer	N. J.	1890	June 1	July 5	5	Plants enfeebled.
31	Rundell	Mich.	1891	May 25	July 5	10	Yellow; like Beebe.
32	Smith Giant	Ont.	1891	May 26	July 9	6	Needs further trial.
33	Smith Prolific	N. Y.	1892	May 30	June 30	10	Try further.
34	Souhegan	N. H.	1878	May 25	June 30	6	Popular; early.
35	Surrey	Ohio?	1890	June 4	July 5	7	Of doubtful value.
36	Sweet Home	Ill.	1891	June 4	July 6	9	Of doubtful value.
37	Tyler	N. Y.	1878	May 26	June 30	9	One of the earliest.
38	Virginia	Ohio?	1890	May 23	June 29	9	Of doubtful value.
39	Winona	Ohio?	1891	May 29	July 2	10	Needs further trial.
40	Wragg	Iowa	1894				Not fruited.

4th. *R. Phœnicolasius.*

Number.	Name.	Origin.	Planted.	First bloom.	First ripe fruit.	Productiveness, scale 1 to 10.	Remarks.
1	Japanese Wineberry	Japan	1891	June 15	Aug. 11	5	A curiosity only.

5th. *R. strigosus.*—Increasing by suckers.

Number.	Name.	Origin.	Planted.	First bloom.	First ripe fruit.	Productiveness, scale 1 to 10.	Remarks.
1	Brandywine	Penn.	1878	June 8	July 6	8	Still popular.
2	Church	Ohio	1892	June 4	July 9	1	The first crop.
3	Cuthbert	N. Y.	1877	June 4	June 30	8	The leading red.
4	Early King		1893				Not yet fruited.
5	Eastern King	Me.	1888	June 4	July 5	5	Not generally valued.
6	Golden Queen	N. J.	1886	June 5	July 9	6	Best yellow variety.
7	Hansell	N. J.	1878	May 26	June 27	6	Valued for earliness.
8	Miller ?	Del.?	1894				Not yet fruited.
9	Reeder	Mich.	1886	June 4	July 3	4	Good family berry.
10	Reliance	N. J.	1880	May 30	July 6	6	One of the hardiest.
11	Scarlet Gem	Kan.	1887	May 25	July 2	4	Showy; unprofitable.
12	Thompson	Ohio?	1890	May 28	July 1	5	Lacks productiveness.
13	Turner	Ill.	1883	June 5	July 5	4	Extremely hardy.

Since the space available for remarks in the foregoing tables is inadequate for proper or full characterization, more complete particulars are appended, in the case of many of the tabulated varieties.

Herstine, though an American seedling, is claimed to be at least partially of foreign parentage. It is clear and bright in color, of fine size, and superior flavor. The plant is only moderately vigorous, and lacks hardiness even in this lake shore climate. With slight protection it is a superior variety for the family garden.

Marlboro, notwithstanding its alleged partially foreign parentage, is fairly hardy. It is large and well colored, though not of superior flavor. It is specially a market variety.

Thwack, though but recently planted upon the station grounds, was well tested here, many years since, and abandoned on account of its sad lack of quality. The plant is vigorous and hardy, and the fruit large, bright, and firm, but rather dry, and, for this reason, a good handler.

Cardinal (which appeared in last year's report as Griesa—the name of the originator), is a native of Kansas. It is one of the few varieties which may be rooted from both suckers and tips, though somewhat reluctantly from either. The characteristics are intermediate between *strigosus* and *occidentalis*, more nearly approaching the former, in this, as well as in the only slightly darker color of the fruit. So far it proves moderately vigorous, hardy, and productive. Furthertrial is needful to fully determine its value.

Caroline is an alleged hybrid between *Idæus* and *occidentalis*. It is very hardy and productive. The color of the fruit is a beautiful pale yellow. It is soft, rather acid, and lacks size. The plant propagates, reluctantly, by either suckers or tips.

Gladstone is a comparatively recent introduction, named for the noted English statesman of this name. So far its summer crop of fruit scarcely justifies so distinguished a name. It, however, produces a profuse autumnal crop, upon the current season's canes, which, unfortunately, is quite liable to be ruined by frost while yet immature.

Muskingum is a comparatively recent variety from Ohio. In habit of growth it approaches *strigosus*, though with the greater vigor of *occidentalis*. The fruit is much like that of Shaffer, though smaller and somewhat brighter. It suckers sparingly, and, so far, betrays little if any tendency to root from the tips.

Shaffer is well and favorably known as a very vigorous grower and profuse bearer, rooting only from tips. The pubescence and dark color of the fruit are disliked in the market, though, upon acquaintance, its other and desirable qualities, to a great extent, override this objection. The young canes of newly set plants often produce a partial crop of fruit in autumn.

Ada has not, so far, afforded promise of value.

American Everbearing has not yet shown fruit.

Beebe is a yellow cap, a prolific bearer, but with too many grave faults to be worth planting.

Canada was tested here several years since and found wanting.

Carman has desirable characteristics, but with Souhegan, Tyler, Cromwell, and others of similar character and season, it can scarcely be expected to win popularity.

Centennial also lacks the superior qualifications needful to enable it to rise above its numerous competitors.

Conrath, Cromwell, and Doolittle are too similar to others which have preoccupied the field, to justify the expectation of wider popularity than they already enjoy.

Doomore, as tested here, possesses little if any value.

Earhart is desirable, if at all, for its habit of producing a crop upon last year's canes, at the usual season, and a second crop in autumn, upon canes of the current year's growth. Reckoning both crops, it may be said to be fairly productive.

Farnsworth fruited this year for the first time. It gives indications of value which justify its trial, on at least a limited scale, as a commercial variety.

Green, new, planted last spring, has not fruited here.

Gregg has so long been a leading market variety that extended notice is not necessary. The dense pubescence upon the fruit and a slight lack of hardiness are its most serious defects.

Hathaway, 1 and 2, seedlings received for trial, from B. Hathaway of Cass county, Michigan, have now fruited. No. 2 proves to be the better variety, and is apparently worthy of further trial. It is understood, however, that the originator has determined to withhold them from dissemination, as scarcely up to his standard of merit.

Hilborn may be properly placed at the head of our list of blackcaps, so far as quality is concerned, though it has not acquired prominence as a commercial variety.

Hopkins, Indiana, and Johnston are occasionally planted for commercial purposes, the last more especially for drying. Their popularity has apparently passed its culmination.

Idaho, although for some time a candidate for popular favor, possesses too little merit to justify commendation.

Kansas, though a comparatively recent candidate for popularity, possesses vigor, size, bright color, and productiveness. It is evidently winning a a deserved reputation as a market variety.

Lovett, black cap, suffered more or less injury from continued, drenching rains soon after planting. For this reason replanting may be found necessary to properly develop its actual merits.

Mammoth Cluster, once very popular, is now nearly out of cultivation, newer and superior varieties having superseded it.

Mohler, a recent variety originating in Ohio, produced its first full crop of fruit this season. It gives decided indications of value and is worthy of extensive trial.

Nemaha comes from Nebraska, and is to all outward appearances merely a reproduction of the Gregg. It is, however, alleged to be its superior so far as hardiness is concerned.

Ohio is popular among commercial planters, apparently largely on account of its large yield after drying. It is probable, however, that the excess of weight, when dried, is largely if not wholly due to its excessive seediness.

Older, a recent variety from Iowa, is said to be drouth-resisting, hardy, with clear, bright color, size, and productiveness. It produced its first full crop here this year. So far it gives promise of value.

Palmer has now been sufficiently tested to determine that it has no superior, if in fact an equal, among the older varieties of the same season. For commercial planting it may be fairly conceded the leading position among the earlier varieties, as indicated by results here.

Pioneer was considerably injured soon after planting by the continued wet weather at the time, and from that or other cause has not, so far, afforded satisfactory results.

Rundell is but a reproduction of Beebe, with its peculiarities and faults.

Smith Giant and Smith Prolific are yet too imperfectly tested to be characterized.

Souhegan and Tyler, though doubtless of distinct origin, are for all practical purposes identical. They are too well known to require characterization.

Surrey and Sweet Home, though planted several years since, have so far failed to develop valuable characteristics.

Virginia, for one cause or another, seems to be in the same condition with the foregoing.

Winona was nearly ruined by continuous wet soon after planting, and has not, even yet, fully recovered.

Wragg, a new blackcap from Iowa, was received and planted last spring.

Japanese Wineberry still maintains its reputation as without value, save as a curiosity.

Brandywine, though an old variety, still stands scarcely lower than second, as compared with Cuthbert or other leading red varieties.

Church (Royal Church) has yet to establish a reputation here.

Cuthbert is very generally recognized as the leading commercial red raspberry.

Early King, though only planted this season, has shown a few fruits. From the foliage and vigor it may be regarded as promising.

Eastern King has been on trial here several years, but has not, so far, developed valuable qualities.

Golden Queen, although somewhat deficient in productiveness, is large and very beautiful in fruit, which holds its rich, golden color, even when overripe. The plant possesses the habit and vigor of the Cuthbert, from which some persons assume it to be a sport.

Hansell is mainly valued for its earliness. It is hardy, but only moderately vigorous. The fruit is somewhat deficient in size.

Miller was received last spring for trial. There being several varieties of this name, it may be impossible to determine which is intended, till the plants are in fruit.

Reeder was received from the late W. A. Brown, as Reder; but since the former orthography is adopted by A. A. Crozier, in bulletin 111, it is assumed to be correct, and adopted herein. Though not adapted to commercial planting, its fine size, beautiful color, and superior flavor specially fit it for the home plantation.

Reliance, though slightly lacking in size, is of high quality, and seems well adapted to localities where superior hardiness is requisite.

Scarlet Gem, as grown here, fails to develop qualities such as will warrant its commendation for extensive planting for any purpose.

Thompson has, this season, borne a moderate crop. Although received and planted several years since, it has heretofore proved a very thin bearer.

Turner is doubtless the hardiest of the red varieties. It is too small and too delicate in texture to be recommended for even the home plantation, except in localities where *special* hardiness is necessary.

BLACKBERRIES (*Rubus villosus*).

The stand of blackberry plants, injured as they were by the almost continuous rains of two years ago, remain in such uneven condition that resort is again had to estimates of comparative productiveness, as has been done in the case of raspberries.

In common with the entire plantation, on March 15 to 19, the blackberries received a spray, consisting of one pound of copper sulphate dissolved in twenty-five gallons of water.

A second spray was given on May 17, consisting of 4 pounds of copper sulphate and 4 pounds of stone lime in 32 gallons of water.

The repairing of the injuries referred to, and in so doing securing an even and otherwise satisfactory stand of plants, proves so difficult, not to say impossible, that the replanting of the varieties, in a different locality, is contemplated, to be done, at least in part, the coming spring, when such as shall have proved unworthy, as well as such worthy ones as may not require further trial, can be omitted, retaining such as shall be deemed necessary for purposes of comparison.

The facts respecting place and date of origin are frequently unobtainable or at least unreliable; for this reason the localities from which plants were received are in such cases given instead.

TABULATED LIST OF BLACKBERRIES.

Number.	Name.	Origin.	Planted.	First bloom.	First ripe fruit.	Productiveness. Scale, 1 to 10.	Remarks.
1	Agawam	N. E.	1888	May 20	July 17	7	Large; excellent.
2	Ancient Briton	Eng.?	1888	May 23	July 18	7	Origin uncertain.
3	Bonanza		1888	June 1	July 14	5	
4	Childs (Tree)	N. Y.	1892	June 5	July 27	2	Not promising.
5	Early Cluster	N. J.	1888	May 28	July 17	6	Value doubtful.
6	Early Harvest	N. J.	1888	June 4	July 5	10	Very early.
7	Early King	N. J.	1890	June 1	July 13	9	Very promising.
8	Early Mammoth	Ohio	1891	June 1	July 12	8	Further trial.
9	Eldorado	Ohio	1892	May 26	July 30	2	But partially tested.
10	Erie	Penn.	1888	June 1	July 19	5	Very vigorous.
11	Fruitland	Ohio	1892	June 5	July 30	3	Promising.
12	Hoosac	Mass.	1891				Thornless.
13	Kittatinny	N. J.	1888	June 4	July 17	7	Excellent; not hardy.
14	Knox		1888	May 29	July 20	5	Vigorous; fruit large.
15	Lawton	N. Y.	1888	May 29	July 20	5	Still popular.
16	Lincoln	Ag. Col.	1891	May 26	July 21	9	Partially tested.
17	Maxwell	N. J.	1894	June 7			Not yet fruited.
18	Minnewaski	N. Y.	1888	May 31	July 21	6	Usually productive.
19	Nevada		1888	June 1	July 19	6	Not valuable.
20	Ohmer	Ohio	1892	May 24	July 23		Try further.
21	Oregon (Everbearing)	Oregon	1892	June 15	Aug. 8	6	A curiosity.
22	Sanford	N. Y.	1894				Not yet fruited.
23	Snyder	Ind.	1888	May 23	July 13	10	Very vigorous; hardy.
24	Stone	Wis.	1890	June 1	July 28	7	Hardy; too small.
25	Taylor	N. J.	1888	May 30	July 26	6	One of the best.
26	Thompson	Ohio	1890	May 29	July 17	6	Needs further trial.
27	Wachusett	Mass.	1890	May 26	July 17	6	A thornless plant.
28	Wallace	Wis.	1888	May 30	July 21	4	Usually productive.
29	Western Triumph		1888	May 29	July 23	10	Fruit lacks size.
30	Wilson	N. J.	1888	May 29	July 17	10	Large; plant tender.
31	Wilson, Jr.	N. J.	1888	May 26	July 18	10	Like Wilson.

For the purpose of giving particulars, for which room could not be had in the foregoing table, the following notes are appended:

Agawam had been grown here for a considerable period before the establishment of the Experiment Station. From this lengthened trial it appears to be unusually well adapted to family use, it being hardy, vigorous, and fairly productive of large fruit of fine quality.

Ancient Briton is well and generally known as a market variety, especially at the west. It is hardy and vigorous, but inclined to overbear and the fruit to become small, unless under thorough cultivation and efficient thinning. It is claimed to be an importation from England; but the claim seems open to doubt, since neither this nor any other cultivated blackberry is known to have attracted special attention in that country.

Bonanza, notwithstanding its highly pretentious name, has utterly failed to establish a reputation for value here or, so far as we have learned, in any other locality.

Childs (Tree) although not yet fully tested promises, so far, to find its appropriate place upon the rejected list.

Early Cluster is put forward by a New Jersey nurseryman. A somewhat extended trial has shown it to be of no value here.

Early Harvest is early, as its name indicates. Under thorough cultivation only, should it be expected to yield profitable crops.

Early King ripens slightly in advance of the average season. The fruit is large and abundant, and fully medium in quality. It is apparently well worthy of trial.

Early Mammoth claims too much in its name. Upon a short trial it is not especially large. Further trial is needful to determine the measure of its productiveness.

Eldorado is yet too recent here to warrant its characterization.

Erie is large, and the plant fairly hardy, as well as especially vigorous. As compared with several others it somewhat lacks productiveness.

Fruitland, a new variety received from Ohio, has not yet had time to develop its qualities.

Hoosac is a thornless variety of little apparent value.

Kittatinny is one of the oldest, largest, and finest varieties in cultivation. The plant is somewhat deficient in hardiness and is said to be specially liable to the attacks of a fungus known as red or orange rust.

Knox is a vigorous grower and the fruit of large size and good quality. It is however lacking in productiveness.

Lawton is an old, well known variety which yet maintains a somewhat uncertain standing among commercial varieties.

Lincoln is too recent to warrant its recommendation, although so far it promises well.

Maxwell was first planted here last spring. It was received from Michigan Agricultural College and also from New Jersey.

Minnewaski was received many years since from the late A. J. Caywood of New York. It is vigorous, moderately productive of fruit of good size. Its position as a commercial variety is a doubtful one.

Nevada is not valuable here.

Ohmer has not yet had time here to fully develop its character. So far it may safely be set down as promising.

Oregon (everbearing) is a curiosity. The foliage is very finely lobed or "cut leaved," and the canes are very thickly set with strong spines. The plant is of habit intermediate between the blackberry and the dewberry. Fruit rather below medium size, ripening in succession through a period of considerable length.

Sanford, planted last spring. Plants received from New York.

Snyder is unusually vigorous and productive. The fruit is superior in quality although deficient in size. Valuable, especially where great hardiness is requisite.

Stone is a spreading, low-growing plant and very hardy. The fruit is quite too small to suit the popular fancy.

Taylor is vigorous and productive, scarcely if at all less hardy than Snyder, and the fruit of fully medium size and good quality. Rather later than the average.

Thompson came from Ohio with a pretentious handle to its name, which is omitted here. Further trial is needful to establish its character here.

Wachusett is a thornless variety originated many years ago. It is of no particular value anywhere, save as a curiosity or novelty.

Wallace was received many years ago, as a new variety from Wisconsin. It is vigorous and hardy in our lake shore climate, and moderately productive of fruit of fine size and good quality.

Western Triumph has much of the vigorous habit and tendency to over-productiveness of the Briton, and is considered hardy, but unless given superior culture or severe thinning, or both, its size will be quite too small.

Wilson and Wilson Jr., are practically identical. The plants so lack hardiness that winter protection is needful even in the lake shore fruit belt. The fruit also, though of the largest size, is poor in flavor, though readily salable in the market.

SERVICE BERRY (*Amelanchier*).

Although this in our forests may occasionally occur as a small tree, the variety in cultivation is a comparative dwarf, rarely above three or four feet in height.

The fruit resembles the huckleberry in general appearance, though lacking in flavor as compared with that fruit. Birds are especially fond of the fruit, so much so that we have only been able to save any portion of the crop till maturity by covering it with netting.

There is but slight difference in either vigor or date of blooming or ripening among the three varieties grown here this season, and the same is true of their productiveness, and the size and general character of the fruit.

The bloom of all opened not far from the first of May, and the fruit, (having been protected by netting,) was gathered fully ripe, June 26.

A portion of the fruit prepared as is customary with huckleberries, proved to be greatly deficient in quality, as compared with that fruit.

CURRANTS (*Ribes*).

Between the depredations of the twig borer, (*Ægeria tipuliformis*, Linn.) and the injury from excessive wet two years ago, the stand of plants of many if not most varieties is far from satisfactory, so much so, indeed, that the putting out of an entirely new plantation seems indispensable.

Currants received a spray of copper sulphate, on March 15, before the commencement of growth, in common with the remainder of the plantation.

Being in rows adjacent to gooseberries, both were sprayed on May 7 with potassium sulphide.

The currant worm (*Nematus ventricosus*, Klug,) having made its appearance, a spray of Paris green was applied May 14, and, rain having occurred, it was repeated on the 15th. This not proving fully effective, a spray of two tablespoonsful of buhach in ten quarts of water was applied on the 16th.

More or less currant worms still remaining, a spray of Paris green was again applied May 19. Rain followed on the 20th and 21st.

To prevent mildew, both currants and gooseberries were sprayed on the 22d, using 3 oz. potassium sulphide in ten gallons of water. The same preparation was again applied on June 1.

Mildew was discovered on the foliage and fruit of a single plant of Triumph gooseberry, the plant being under the lee of an evergreen screen.

Sprayed currants and gooseberries with potassium sulphide on June 20, and, aphides having appeared on several plants, these were also sprayed with buhach in water. This not proving sufficiently effective, a second spray was given June 25 with strong tobacco water, care being taken to apply it to the under sides of the leaves.

June 27, again sprayed currants and gooseberries with tobacco water, for currant worms.

June 29 repeated the same.

June 30 repeated the potassium sulphide spray for mildew.

July 14 repeated the potassium spray on gooseberries and currants.

July 28 gave currants and gooseberries a final spray of potassium sulphide.

The fact that the Paris green and buhach were less effective than was anticipated, may probably be charged in part to the occurrence of rain; and, perhaps, in part, to adulteration of those insecticides. The tobacco water was prepared on the premises, and proved quite as effective as the other applications.

With the exception of the cases already noted, no other important insect or fungous depredations have been observed, except that, in the effort to suppress the twig borer, considerable bearing wood has necessarily been sacrificed.

1. BLACK FETID CURRANTS (*Ribes nigrum*).

Number.	Name.	Origin.	Planted.	Bloom.	Ripening.	Productiveness. Scale, 1 to 10.	Remarks.
1	Champion (Black)	Eng.	1889	May 3	July 9	6	
2	English (Black)	Eng.	1879	May 3	July 11	5	
3	Lee	Eng.	1888	May 1	July 1	4	
4	Naples (Black)	Eur.	1888	May 7	July 9	5	
5	Saunders	Ont.	1890	May 1	July 1	6	
6	Wales (Prince of)	Ont.	1890	May 3	July 9	1	

2. MISSOURI, OR YELLOW FLOWERING CURRANT (*Ribes aureum*).

Number.	Name.	Origin.	Planted.	Bloom.	Ripening.	Productiveness. Scale, 1 to 10.	Remarks.
1	Crandall	Kan.	1889	April 26	July 9	4	Not valuable.

3. RED AND WHITE CURRANTS (*Ribes rubrum*).

Number.	Name.	Origin.	Planted.	Bloom.	Ripening.	Productiveness. Scale, 10 to 1.	Remarks.
1	Cherry	Eur.	1888	April 28.	July 1.	2	Plants feeble.
2	Fay	N. Y.	1888	April 28.	July 1.	4	Plants feeble.
3	Holland (Long Bunched)	Eur.	1889	April 28.	July 8.	5	Injured by aphis.
4	Lakewood	Ohio	1890				Not vigorous.
5	London (Red)	Eur.	1890	April 30.	June 30.	10	Hardy; vigorous.
6	Moore Ruby	Am.	1890	April 28.	July 2.	4	High quality.
7	Moore Select	Mass.	1890	April 30.	July 1.	1	Success doubtful.
8	North Star	Minn.	1892	April 28.	July 1.	4	Very vigorous.
9	Red Dutch	Eur.	1888	April 28.	July 1.	5	Old; valuable.
10	Ruby Castle	Ind.	1892	April 28.	July 1.	5	Promising.
11	Versaillaise	Fr.	1888	April 30.	July 1.	4	Much like Cherry
12	Victoria	Eng.	1888	April 30.	July 1.	7	Profitable.
13	White Dutch	Eur.	1888	April 30.	July 1.	5	Fine flavor.
14	White Gondoin	Eur.	1890	April 30.	July 2.	9	Promising.
15	White Grape	Eur.?	1888	April 30.	July 1.	6	Market.
16	Wilder	Am. ?	1890	April 30.			Doubtful value.

The estimates of relative productiveness given in the foregoing table are probably so affected by conditions which could not be considered at the time, that they are quite likely to improperly affect the conclusions arrived at, which therefore are to be taken with at least some degree of allowance.

So far as tested the several varieties of black currant show little apparent variation. To insure productiveness they should be so pruned as to supply a sufficiency of young bearing wood, by removing the old canes which have ceased to be productive.

Crandall can not be accepted as a hybrid, as was claimed when first offered. If desirable at all it can only be as a curiosity; or, at the best, as the possible progenitor of something very much better.

Cherry and Fay have been nearly ruined by cutting away the canes, in the process of subduing the twig borer, to whose depredations, apparently, they are especially subject.

Holland is the most vigorous of the red currants, and holds its very large foliage well to the close of the season. With its long bunch, even though the berry lacks size, it is usually one of the most productive.

Lakewood, though a good grower, has not, so far, proved productive.

London (Red) is scarcely second to Holland in vigor of growth, while this year it has excelled all others in productiveness.

Moore Ruby is apparently worthy of more attention by those who desire superior quality for the home plantation.

Moore Select has, so far, betrayed lack of both vigor and productiveness.

North Star developed a very vigorous growth. Its productiveness is yet undetermined here. Size of fruit, so far, not above medium.

Red Dutch has, even yet, few if any equals, all things considered. Exceeding in vigor, it very nearly equals the largest in size of fruit, when given rich soil and thorough cultivation with judicious pruning.

Ruby (Raby?) Castle needs a further trial to develop its character here.

Versaillaise is very much like Cherry, though doubtless of distinct origin.

Victoria is popular as a market variety in western Michigan, on account of its at least partial exemption from the attacks of the twig borer. It also usually retains its foliage later than most varieties.

White Dutch is scarcely as vigorous as Red Dutch, but is fully its equal in other respects, and in quality for the dessert it is unequaled.

White Gondoin closely rivals White Dutch, in most particulars, even including its superior dessert qualities.

White Grape is perhaps slightly the largest of the white currants, and though objectionably straggling in growth is rather popular as a market variety.

Wilder needs a longer trial. It has not maintained its previous reputation the past season.

GOOSEBERRIES (*Ribes*).

Gooseberries and currants, being in adjacent rows, received the same treatment, so far as spraying is concerned; and the reader is therefore referred to the preceding section for an account of the same.

Only in the case of a plant or two of Triumph (of European parentage), growing adjacent to the eastern side of a tall evergreen screen, was either plant or fruit apparently attacked by mildew, unless we except a few plants of Smith, which made no new growth, and produced no fruit, dropping their foliage very early. This apparent lack of vitality may probably be due to the circumstance that these plants were considerably injured by the freezing and thawing, and consequent heaving, of the soil—a casualty to which this variety is specially liable, on account of its inherent lack of vigor.

The crumpling of the leaves near the tips of the shoots of several of the more slender growers, due apparently to the presence of a minute aphid, has been somewhat more prevalent than heretofore.

With the exceptions noted, there have been no noteworthy visitations of either insects or fungi.

1. EUROPEAN GOOSEBERRY (*Ribes grossularia*). Also American seedlings and crosses.

Number.	Name.	Origin.	Planted.	First bloom.	Ripened.	Product, 1 to 10.	Quality, 1 to 10.	Vigor, 1 to 10.	Size, 1 to 10.	Color.
1	Auburn	N. Y.	1890	April 30	July 2	1	9	5	9	Red.
2	Bendelon	Mich.	1894							
3	Champion	Ag. Col.	1893	May 1	July 14	4	6	7	6	Green.
4	Golden (Prolific)	N. Y.	1890							Yellow.
5	Industry	Eng.	1889	April 28	July 9	7	8	9	10	Red.
6	Keepsake	Ag. Col.	1894							
7	Lancashire Lad	Ag. Col.	1894							
8	Orange (Early)	N. Y.	1890	April 30	July 1	7	9	8	5	Yellow.
9	Pearl	Ont.	1890	April 28	July 9	10	9	10	6	Green.
10	Red Jacket	Ag. Col.	1894	April 30	July 17	2	8	8	10	Red.
11	Triumph	N. J.	1891	April 28	July 9	7	8	9	10	Green.

2. SMOOTH GOOSEBERRY (*Ribes hirtellum*).

Number.	Name.	Origin.	Planted.	First bloom.	Ripened.	Product, 1 to 10.	Quality, 1 to 10.	Vigor, 1 to 10.	Size, 1 to 10.	Color.
1	Houghton	N. E.	1888	April 28.	July 9	10	9	10	4	Red.
2	Pale Red	Am.	1890	April 28.	July 9	9	9	10	5	Red.

3. WILD GOOSEBERRY (*Ribes cynosbati*).

Number.	Name.	Origin.	Planted.	First bloom.	Ripened.	Product, 1 to 10.	Quality, 1 to 10.	Vigor, 1 to 10.	Size, 1 to 10.	Color.
1	Apex	Oregon	1892	May 1.						
2	Chautauqua	Ag. Col.	1891							
3	Downing	N. Y.	1888	April 28.	July 12.	8	5	10	7	Green.
4	Mountain	N. Y.	1888	May 1	July 9	9	3	10	5	Red.
5	Smith	N. E.	1888	April 28.	July 5	7	8	5	7	Green.
6	Strubler	Ill.	1892	May 1	July 11.	1	10	9	6	Green.
7	Tree	Ohio	1892	May 3	July 23.	5	5	9	5	Red.

In the absence of a column for remarks in the foregoing tabulation occasion is taken to more fully elaborate the following notes:

Auburn was obtained several years ago without name, from the place of that name in New York. Its correct name is unknown. Although unmistakably of the European type, it has, so far, been free from mildew. The fruit is large and of superior flavor.

Bendelon is a seedling of the European type, which originated several years ago in Detroit, Michigan, and is said to have been, so far, free from mildew. It was received for trial last spring from a gentleman of that name.

Champion is apparently partially or wholly of European parentage. It comes to this sub-station without history and, so far, promises well.

Golden (Prolific) was received and planted in 1890; but either from the injury of two years ago or from inherent feebleness, it has made little growth and has failed to fruit this year.

Industry has been several years under cultivation here, but for some time it mildewed badly. With spraying the past two years it has recovered and has this season produced a fine crop of fruit free from mildew, which is, no doubt, to be attributed to the free use of potassium sulphide.

Keepsake and Lancashire Lad are varieties of foreign origin received and planted last spring.

Orange (Early) and Pearl are of foreign parentage, the former in New York and the latter in Ontario. They can only be expected to succeed in this climate by a resort to thorough spraying with fungicides.

Red Jacket is a comparatively recent introduction and promises both vigor and productiveness. Time is needful yet, to determine its character.

Triumph is a variety partially or wholly of foreign parentage, received from New Jersey. Planted in 1891, it already gives promise of value. It may be regarded as eminently worthy of trial.

Houghton and Pale Red are very much alike, the latter of a more upright habit of growth. Lack of size is their most serious fault.

Apex comes from Oregon, and is reputed to be a native seedling. Not having fruited here, no description can yet be given. In growth and general appearance the plant somewhat resembles the European type.

Chautauqua, planted last spring, is apparently a native. It has not fruited here, but is reputed to be very productive.

Downing, the most popular market variety here, is too well known to require a lengthened notice. There is much in its habit of growth to beget the suspicion that its parentage may be partially foreign.

Mountain is an unmistakable wildling. With the now numerous competitors, it should doubtless be retired.

Smith, a reputed native, is larger and of better flavor than Downing, and but for its slender, weak habit of growth would probably supersede it.

Strubler (the name of the originator), has now produced a few specimens of superior flavor. The plant is vigorous. It is apparently a seedling of the wild type. The fruit is green when mature.

Tree is also apparently of the native wild type. Productiveness yet undetermined. Plant vigorous and healthy. Fruit red when mature.

CHERRIES (*Prunus*).

The ground occupied by the older cherry plantation is sandy, with a clay subsoil. These trees suffered serious injury from the continuous wet weather of the spring and early summer of 1893. The injury was so apparently serious during the next year that it was anticipated that the injury would prove fatal.

During the autumn of 1893 this ground was thoroughly tile drained, with the result that, apparently from this cause, during the growing season of 1894, these trees, with but three or four exceptions, have almost wholly recovered their vigor and health.

During the unseasonably warm weather of last February and March the fruit buds had become swelled almost to the point of bursting into bloom, and were caught in this condition by the snow storm of March 25 to 28—the mercury running down from 50° on the 22d to 16° on the 28th, with snow varying from six inches to two feet in depth, resulting in the utter ruin of the fruit buds of some varieties and the serious injury of many others.

Following the spray of copper sulphate given the cherries in common with other fruits, on March 15 to 19, a spray, consisting of 4 lbs. each of copper sulphate and stone lime with three ounces of Paris green in 32 gallons of water, was given a portion of the cherries on May 17, and on the 23d the same, omitting the Paris green, was applied to the remainder of the cherries.

Commenced jarring for curculio (on May 23), finding very few on cherries.

The cherry slug (*Eriocampa cerasi*), made its first appearance July 2 to 6, and was treated with a strong extract of tobacco, which proved effectual for the time.

A second appearance of the slug, August 21 and 22, was similarly treated.

The spray of Bordeaux mixture and Paris green applied to cherries June 30 to July 2, was given with reference to the possible attacks of the curculio; but, owing possibly to their preference for the plums near by, there have been no indications of their depredation upon the cherry.

Fearing that another year's rapid growth of a block of sixty cherries, many of which are sweet or Mazzard varieties, might render them liable to "bark burst," the ground was last spring seeded with grass, a matter which would have been deferred at least a year had the very severe drouth of last summer been foreseen.

Since the sweet or Mazzard varieties are so intermixed by crossing or otherwise, and are not recognized as botanically distinct, they are tabulated together and, since few of any varieties are yet in full bearing, productiveness is omitted.

BIGARREAU AND HEART CHERRIES (*Prunus avium*).

Number.	Name.	Class.	Origin.	Planted.	First bloom.	Ripe.	Remarks.
1	Badacconyi	Avium	Aust.	1894			Not fruited.
2	Baltavari	Avium	Aust.	1894			Not fruited.
3	Centennial	Avium	Am.	1893			Not fruited.
4	Cleveland	Big.	Ohio	1890			Buds killed.
5	Coe	Heart	Conn.	1888	April 20	June 18	Very beautiful.
6	Downer	Heart	Mass.	1888	April 28	June 23	Hardy; productive.
7	Eagle	Heart	Eng.	1888	April 28		Excellent.
8	Early Purple	Heart	Eur.	1891			The earliest.
9	Elton	Big.	Eur.	1890			Excellent.
10	Florence	Big.	Italy	1891			Not fruited.
11	Knight (Early)	Heart	Eng.	1890			Not fruited.
12	La Maurie	Heart	Eur.	1892			Not fruited.
13	Mary (Kirtland)	Big.	Ohio	1890			Not fruited.
14	Mastodon	Avium	Mo.	1893			Not fruited.
15	Moduyansky	Avium	Aust.	1894			Not fruited.
16	Napoleon	Big.	Eur.	1892			Not fruited.
17	Ohio	Heart	Ohio	1890			Not fruited.
18	Purity	Avium	Ag. Col.	1891			Not fruited.
19	Rockport	Big.	Ohio	1890			Not in fruit.
20	Schmidt	Avium	Ag. Col.	1891			Not fruited.
21	Tartarian	Heart	Eur.	1888	April 30		Not fruited.
22	Ulatis	Avium	Col.	1893			Not fruited.
23	Windsor	Big.	Ont.	1890	April 30	July 3	New; late.
24	Wood	Heart	Ohio	1890			Not fruited.
25	Yellow Spanish	Big.	Eur.	1890	April 30		Not fruited.

DUKES AND MORELLOS (*Prunus cerasus*).

The Dukes differ so greatly in habit of growth, foliage, and fruit from the Mazzards on the one hand, and from the Morellos on the other, as to indicate the possible blending of the two some time in the remote past, by cross-fertilization, and yet botanists fail to treat the Dukes as a distinct species. They are therefore classed with Morellos.

Number.	Name.	Class.	Origin.	Planted.	First bloom.	Ripe.	Remarks.
1	Abbesse	Morello.	Rus.	1888	May 1	July 18	Feeble grower.
2	Angouleme	M.	Rus?	1888	April 30	July 17	Very vigorous.
3	Baender	M.		1892	April 30		Failed to fruit.
4	Bessarabian	M.	Rus?	1888	April 30	July 18	From Prof. Budd.
5	Brusseler Braune	M.	Rus?	1888	May 1		From Prof. Budd.
6	Carnation	Duke	Eur.	1890	April 30	June 30	Fruited lightly.
7	Choisey	D.	Eur.	1888	April 30		Beautiful; excellent.
8	Dyehouse	M.	Am.	1890	April 30	June 18	Slender; straggling.
9	Esperen	M.	Eur.	1892	May 3		Not fruited.
10	Eugenie	.	Eur.	1888	April 30	July 3	Amateur.
11	Everbearing	M.	Am.	1892	May 2		Failed to fruit.
12	Frauendorfer (Weichsel)	M.	Ger?	1888	April 30		Failed to fruit.
13	Galopin	M.		1892			Not fruited.
14	George Glass	M.	Ger?	1888	May 1	June 23	From Prof. Budd.
15	Griotte du Nord	M.	Eur.	1888	April 30		From Prof. Budd.
16	Hoke	D.	Penn.	1894			Well spoken of.
17	Hortense	D.	France	1888	April 30		Failed to fruit.
18	King Amarelle	M.	Eur.	1892			Not fruited.
19	Late Duke	D.	Eur?	1890	April 30	June 30	Fruit buds killed.
20	Lithauer Weichsel	M.	Ger?	1892	April 30		Not fruited.
21	Lutovka	M.	Eur.	1888	April 30		Failed to fruit.
22	Magnifique	D.	Fr.	1888	April 30	July 13	Excellent; late.
23	May Duke	D.	Eur.	1888	April 30		Failed to fruit.
24	Minnesota	M.	Minn?	1892			Not fruited.
25	Montmorency	M.	Eur.	1888	April 30	June 20	Productive.
26	Montmorency, Large	M.	Eur?	1890	April 30	June 21	Slender; drooping.
27	Montmorency, Ordinaire	M.	Eur?	1890	April 30	June 30	Market.
28	Montrueil	D.	Fr.	1890	April 30	June 26	Productive.
29	Northwest	M.	Am.	1893	May 3		Not fruited.
30	Olivet	D.	Am	1892	April 30		Not fruited.
31	Orel 25	M.	Rus.	1892	May 3		Not fruited.
32	Orel 27	M.	Rus.	1892	May 3		Not fruited.
33	Ostheim	M.	Rus?	1888	April 28	June 20	From Prof. Budd.
34	Ostheimer	M.	Rus?	1892	May 3		Not fruited.
35	Phillippe (Louis)	M.	Fr.	1888	April 30		Failed to fruit.
36	Richmond	M.	Eur.	1888	April 30	June 18	Popular.
37	Royal Duke	D.	Eur.	1890	April 30	June 21	Light crop.
38	Sklanka	M.	Rus.	1888	April 30	June 23	Very productive.
39	Spate Amarelle	M.	Rus.	1888	April 30	July 13	Fruited lightly.
40	Strauss Weichsel	M.	Rus.	1888	April 30	June 26	Fruited lightly.
41	Suda	M.		1892	May 3		Not fruited.
42	Weir 2	M.	Ill.	1892	May 3		Not fruited.
43	Wragg	M.	Iowa	1891	May 3	July 13	Small; very acid.

Of the varieties tabulated, notes are appended mainly of such only as have already fruited sufficiently to afford some indication of their character.

In describing cherries, together with the other tree fruits, including grapes (with the single exception of apples, which see), size and quality are expressed upon the scale, 1 to 5, employed for this purpose by the Division of Pomology; and in accordance with the practice of the division 1 is used to express the highest grade, with 1+ to indicate unusual superiority; while 5 indicates the lowest grade to which the grading is intended to apply; with 5— to express anything of still lower value.

Badacconyi, Baltavari, and Moduyansky, as indicated by their foliage and habit of growth, are of the sweet or Mazzard class. These are among a number of varieties, including apples and plums, received from south-eastern Europe by the National Department of Agriculture, and entrusted to this and other stations for propagation and trial.

Cleveland, Coe (Transparent), Downer, Eagle (Black), Early Purple, Elton, Napoleon, Rockport, Tartarian (Black), Wood (Gov.), and Yellow Spanish have all been fruited many years since by the writer, and all can be confidently recommended to those who may desire to plant this class of cherries, for other than commercial purposes.

Windsor has borne lightly this season, and promises to deserve a high position among those of its species, on account of its late ripening and apparent hardiness.

Abbesse, Angouleme, Bessarabian, Brusseler Braune, Frauendorfer, Weichsel, George Glass, Griotte du Nord, Ostheim, Sklanka, Spate Amarelle, and Strauss Weichsel were received from Iowa, coming from the collections of Russian or European introductions obtained by Professor Budd. All have fruited (the most of them very lightly) during the past two years. Sklanka, the only one that has fruited heavily this year, may be regarded as promising for market.

Carnation is an old variety, scarcely at all grown in Michigan. The tree is vigorous and of upright growth. It bore very lightly this year for the first time.

Choisey is of French origin. It makes a beautiful tree, and it has no superior in the beauty and fine quality of its fruit. Unfortunately it is a thin bearer.

Dyehouse is one of the earliest Morellos. The tree has very slender drooping branches.

Eugenie, another French production, is beautiful and excellent, well adapted to the home plantation. Its desirableness for commercial planting is not yet determined.

Hortense is less popular than its real merits would seem to warrant. The fruit is large for a Duke, and the tree is one of the most vigorous of its class.

Late Duke is of fine upright habit. It bore only a few specimens the present year. Its value here remains to be determined.

Magnifique is of French origin, as may be inferred from its name. Its extreme lateness renders it the more desirable.

May Duke is probably, all things considered, the most valuable variety of its class. It is widely known and valued.

Montmorency, and Montmorency Ordinaire, as grown here, are apparently identical. They are apparently adapted to commercial planting.

Montmorency Large is quite distinct from the foregoing, being of more spreading and even drooping habit.

Montrueil, another French variety, is apparently one of the earliest and most prolific bearers of its class, and the fruit is of fine quality and size. Tree vigorous, upright, spreading.

Ostheim, though in bearing, has not yet produced enough to properly determine its value.

Phillipe (Louis) was thoroughly tested many years since. The fruit is large, late, and excellent for culinary purposes. Insufficient productiveness is its most serious fault.

Richmond is too universally known to require description. It is the leading market variety of the northern states.

Royal Duke, though an old variety, is rare in Michigan. It has shown a few fruits here this season, for the first time.

Wragg was originated, or at least discovered, several years ago in Iowa. It is a weak, slender grower, and the fruit rather small, nearly black, acid, and late. It is said to be very hardy and may, for that reason, be desirable in very trying climates.

MULBERRIES (*Morus.*)

Varieties of this fruit usually known as everbearing, and recognized as improved or cultivated and named, are the only ones included in our lists.

Downing is an American seedling from Multicaulis (*M. Alba*), bearing large fruit of improved quality. It is scarcely hardy in southern Michigan. It is exceedingly vigorous and the foliage very large.

New American, though no longer new, on account of its superior hardiness is the most satisfactory variety for Michigan planters. The fruits are of good size, with pleasant, sprightly flavor. But for the habit of dropping the fruit as soon as mature, it would doubtless be more generally planted.

Hicks is a southern variety which so far is less productive, and the fruit of smaller size.

Russian (*M. Siberica* of the nurseries), is desirable, if at all, for hedges, screens, or windbreaks. It is abundantly hardy, tending to a drooping habit. The fruit is very abundant but utterly worthless.

Teas Weeping, grafted on upright stocks, makes one of the most unique of weeping trees.

PEACHES (*Prunus Persica, Amydalus Persica, or Persica vulgaris, of various botanists*).

Of insects, the curculio, as usual, attacked the early, smooth-skinned varieties, but was held in subjection by jarring. The insect apparently preferred the plum trees adjacent, as they were less persistent than upon the plum.

The borer (*Sannina* (*Ægeria*) *exitiosa*), also required attention in September, and treatment with hoe and knife was employed.

An occasional specimen of rose chafer (*Macrodactylus subspinosus*) was disposed of in connection with curculio, by jarring and handpicking.

The cool, moist weather of this region in the spring, due to the prevailing lake winds of that season, are apparently very favorable to the development of curled leaf (*Taphrina deformans*), which was more than usually prevalent throughout this region. The peach trees upon the station grounds, however, were but slightly affected, owing, apparently, to a thorough spray of a solution of one pound of copper sulphate in twenty-five gallons of water.

The fungus (*Sphærotheca pannosa?*) which attacks the foliage and young shoots of the serrate-leaved varieties in summer, also yields to the spray of copper sulphate and to the Bordeaux mixture, though it sometimes reappears later in the season upon the more recent growths, which occur after sprayings have ceased.

The preliminary general spray, consisting of one pound of copper sulphate in twenty-five gallons of water, was applied to peaches March 19 to 21.

Peaches received a spray on May 23, consisting of four pounds each of copper sulphate and lime, in thirty-two gallons of water.

Peaches were included in the general jarring for curculio, but so few were found upon the peaches that they were soon omitted. Jarring was commenced May 22.

On June 9 a third and final spray was applied to peaches, consisting of four pounds copper sulphate and three pounds lime, with three ounces of Paris green in forty-two gallons of water.

The last copious rain of the season occurred on June 26. In early July it became necessary to haul water from the river to be applied to newly planted trees, some of which were beginning to suffer from the extreme heat and lack of moisture. This was done by digging a slight trench about the tree, filling it with water, and replacing the earth after the water had been absorbed. The drouth, which continued with little intermission till October, rendered the continuation of such watering necessary till nearly that date.

Abbreviations occurring in the several columns in the following table, are explained in connection with the heading.

In cases of uncertainty as to origin, the source whence a variety was received is the one given.

Clings are thus designated. The word *free* is only applied to avoid ambiguity. Neither word is to be understood as part of the name.

In many cases names of fruits are simplified in compliance with modern rules of pomology. In occasional cases objectionable portions of names are given in parenthesis.

Descriptions of fruits now in bearing are omitted in the tabulation, and given instead in subsequent notes.

PEACHES.

Alphabetical tabulation.

Number.	Name.	Origin.	Planted.	Flowers—l, large; s, small.	Date of bloom.	Glands—g, globose; r, reniform; s, serrate.	Remarks.
1	Abricotee	Fr.	1890		April 27	r	
2	Adrian	Mo.	1892	s	April 28	g	Not fruited.
3	Alberge	Fr.	1893	s	April 27	g	Not fruited.
4	Albright	N. J.	1890	s	April 27	g	Rec'd as "Good."
5	Allen	Mo.	1890	s	April 28	r	
6	Alpha	Mo.	1890	s	April 28	r	
7	Amelia	Mo.	1890	s	April 28	r	
8	Amsden	Mo.	1890	l	April 27	g	
9	Andrews	Mo.	1890			r	
10	Arctic	Del.	1894				
11	Barber	Mich.	1893	s	April 29	r	
12	Beers (Smock)	N. J.	1890	s	April 28	r	
13	Bell (Favorite)	Del.	1890	s	April 28	r	From Texas.
14	Bequette, cling	Tex.	1890	s	April 27	r	
15	Bequette, free	Tex.	1890	s	April 27	r	
16	Berenice	Del.	1894			r	
17	Bickell	Del.	1890	s	April 28	r	
18	Bishop	Mo.	1890	s	April 27	g	
19	Blood Leaf	Mo.	1892	s	April 28	r	A curiosity.
20	Bonanza	Mo.	1890	s	April 27	r	
21	Boyles	Mo.	1890	s	April 27	g	
22	Brandywine	N. J.	1890	s	April 27	g	
23	Brett	Mo.	1890	s	April 30	r	
24	Brigdon	N. Y.	1890	s	April 27	g	May be same as Garfield.
25	Briggs	Tex.	1890	s	April 27	g	
26	Brunson	Mich.	1894	s	April 28	r	
27	Brown	Mich.	1893	l	April 26	r	
28	Burke	Mich.	1892	l	April 28	r	
29	Canada	Ont.	1892	l	April 26	g	
30	Chair	Ohio	1890	s	April 28	r	
31	Champion	Ill.	1892	s	April 27	g	New; beautiful.
32	Champion (Serrate)	Mich.	1890	s	April 27	s	
33	Chili (Hill's)	N. Y.	1888	l	April 28	r	
34	Chili (2)	Mich.	1888	s	April 27	r	From C. Engle.
35	Chili (3)	Mich.	1888	s	April 27	r	From C. Engle.
36	Chinese, cling	Del.	1890	s	April 27	r	Large; beautiful.
37	Cleffey (Allen)	Mich.?	1890	s	April 27	r	
38	Columbia	N. J.	1890	s	April 28	r	
39	Conkling	N. Y.	1890	s	April 27	r	
40	Connett	Del.	1894			r	
41	Coolidge (Mam.)	Mich.?	1892	s	April 28	g	
42	Corner	Mich.	1890	s	April 29	r	
43	Crosby	Mass.	1892	s	April 28	r	
44	Crothers	Tex.	1890	s	April 27	g	
45	Dennis	Mich.?	1890	l	April 27	g	
46	Diamond	Ohio	1892			g	
47	Druid Hill	Md.	1890	s	April 27	g	
48	Dumont	Mich.	1894			r	
49	Dunlap (W. N. Y.)	Mich.?	1892	s	April 27	r	
50	Dwarf Cuba	Mich.?	1892			r	
51	Early Barnard	Mich.	1888	s	April 27	r	
52	Early Crawford	N. J.	1888	s	April 27	g	
53	Early Crawford Seedling (1)	Mich.	1888	s	April 27	g	From C. Engle.
54	Early Crawford Seedling (3)	Mich.	1888	s	April 27	g	From C. Engle.
55	Early Michigan (15)	Mich.	1894	l	April 27	g	
56	Early Michigan (16)	Mich.	1894	l	April 27	r	
57	Early Silver	Mo.	1888	l	April 27	r	
58	Early York (Large)	Mich.	1892	s	April 26	g	
59	Ede	Mich.	1890	l	April 27	r	
60	Elberta	Ala.	1890	s	April 27	r	Promising.

PEACHES—CONTINUED.

Number.	Name.	Origin.	Planted.	Flowers—l, large; s, small.	Date of bloom.	Glands—g, globose; r, reniform; s, serrate.	Remarks.
61	Ellison	Ohio	1889	s	April 30	r	
62	Engle (Mam.)	Mich.	1892	s	April 27	g	From C. Engle.
63	Ford (New)	Del.	1894			g	
64	Ford (Red)	Del.	1894				
65	Ford (7)	Del.	1894				
66	Ford (2)	Del.	1894			g	
67	Ford (3)	Del.	1894			r	
68	Foster	Mass.	1888	s	April 27	g	
69	Fox	Mo.	1890	s	Apri 27	g	
70	Geary (Hold on)	Del.	1890	s	April 28	r	
71	Gem, cling	Tex.	1890	s	April 27	r	
72	Globe	N. J.	1888	s	April 30	g	Unproductive.
73	Gold Drop	Mich.	1890	l	April 28	r	Market.
74	Grant (Gen.)	Mo.	1890	s	April 27	r	
75	Great Western	Mo.	1892	s	April 28	r	
76	Gudgeon	Mo.	1890	s	April 27	r	Late.
77	Haas	Del.	1890	l	April 27	r	
78	Hale	Ohio	1888	l	April 29	g	
79	Hale x Oblong	Mich.	1888	l	April 27	g	From C. Engle.
80	Hale x Round	Mich.	1888	l	April 27	g	From C. Engle.
81	Hance Golden	N. J.	1890	s	April 27	g	
82	Hance Smock	Del.	1890	s	April 28	r	
83	Heath, cling	Md.	1890	s	April 28	r	
84	Hughes I X L	Mo.	1892	l	April 28	r	
85	Hyatt	N. J.	1888	l	April 28	g	
86	Hynes	Tex.	1890	s	April 27	g	Promising.
87	Hyslop, cling	Mo.	1892	s	April 30	r	
88	Ice Mountain	Del.	1894			r	
89	Infant Wonder	Mo.	1892	s	April 27	g	
90	Ingold	Tex.	1892	l	April 29	g	
91	Jacques	N. J.	1892	s	April 28	g	
92	Jacques Late	Mich.	1890	s	April 27	g	
93	Japan Dwarf	Del.	1894				
94	Jones	Mo.	1894	s	April 28	g	
95	June Rose	Tex.	1890	l	April 27	g	
96	Juno	Del.	1894			r	
97	Kalamazoo	Mich.	1890	s	April 28	r	Market.
98	Kallola	Mich.	1892	l	April 27	r	
99	La Fleur	Mich.	1894			r	
100	Lancaster	Penn.	1894				In bud only.
101	Late Barnard	Mich.	1892	s	April 30	r	
102	Late White	Mich.	1889	s	April 27	r	From C. Engle.
103	Lemon, cling	Mich.	1888	s	April 30	g	
104	Lemon, free	Ohio	1894			r	
105	Lewis	Mich.	1890	l	April 27	r	
106	Lock, cling	Mo.	1892	s	April 27	r	
107	Longhurst	Mich.	1894			r	
108	Lovell	N. J.	1892	s	April 26	g	
109	Lovett (White)	N. J.	1890	s	April 27	r	Very late.
110	Magdala	Eur.	1890	s	April 27	r	
111	Mam. Heath	Mo.	1892	l	April 28	r	
112	Marshall	Ohio	1890	s	April 28	r	
113	McCollister	Mo.	1892	s	April 26	r	
114	McKevitt, cling	Mich.	1892	s	April 30	g	Late; fine.
115	Milhizer	Mich.	1892	s	April 30	r	
116	Minnie	Tex.	1890	s	May 1	r	
117	Minot	Mich.	1889	s	April 27		
118	Moore	N. J.	1890	s	April 27	g	
119	Morris County	Del.	1890	s	April 27	r	
120	Morris White	N. J.	1888	s	April 27	r	

PEACHES.—CONTINUED.

Number.	Name.	Origin.	Planted.	Flowers—l, large; s, small.	Date of bloom.	Glands—g, globose; r, reniform; s, serrate.	Remarks.
121	Mountain Rose	Mich.	1888	s	April 27	g	
122	Muir	N. J.	1890			r	
123	Mystery	N. J.	1888	s	April 27	r	Unproductive.
124	N. Am. Apt	Mo.	1892	l	April 30	r	
125	Nectarine	Eng.	1889	l	April 27	r	
126	Need (Barnard)	Mo.	1890	s	April 27	r	
127	Neil (Marshall)	Mich.	1892	l	April 27	r	
128	Newington, free	Mich.	1893			g	
129	New Prolific	Mich.	1894			g	
130	Normand	Mich.	1892	s	April 28	r	
131	Oldmixon, cling	Eur?	1888	s	April 27	g	
132	Oldmixon, free	Am.	1893	s	April 28	g	Market; dessert.
133	Oriole	Del.	1894			r	
134	Ostrander	Mich.	1892	s	April 27	g	
135	Pallas	Del.	1894				
136	Palmerston	Eng.	1890	l	April 28	g	
137	Pansy	Tex.	1890	s	April 28	r	
138	Pearl	Mich.	1889	s	April 27	g	
139	Peninsular (yel.)	Del.	1894			g	
140	Pickett	Mo.	1890	s	April 28	g	Late.
141	Pratt	N. Y.	1890	s	April 28	r	
142	Prince (R. Ripe)	Del.	1890	s	April 27	g	
143	Princess	Del.	1894			g	
144	Princess (Wales)	Eng.	1889	l	April 27	g	
145	Prize	Mo.	1892	s	April 30	g	
146	Prize 1	Mo.	1890	s	April 27	g	
147	Red Cheek (Neal)	Fr.	1893	s	April 28	g	
148	Red Seedling	Mich.	1893	l	April 27	g	Fine.
149	Reed	N. J.	1890	s	April 29	g	
150	Reeves	Mo.	1890	s	April 27	g	
151	Ringold	Tex.	1890	s	April 27	r	
152	River Bank	Mo.	1892	l	April 30	g	
153	Rivers	Eng.	1888	l	April 27	r	Beautiful and good
154	Robena	D. C.	1894				In bud only.
155	Roser	Mich.	1892	l	April 28	r	
156	Roseville	Mo.	1892	l	April 29	g	
157	R. S. Stevens	N. Y.	1891	s	April 27	r	
158	Salway	Mo.	1890	s	April 28	r	Late.
159	Scott	Ohio	1890	s	April 27	g	
160	Sener	Mich.	1888	l	April 26	r	Unproductive.
161	Shipley	N. J.	1890	s	April 27	g	Late; productive.
162	Smock, free	N. J.	1888	s	April 28	r	
163	Smock X	Mo.	1892	s	April 27	r	
164	Snow Late	Mich.	1890	s	April 27	r	
165	Southern Early	N. J.	1890	s	April 27	r	
166	Spottswood	Del.	1894				
167	Stark Heath	Mo.	1892	s	April 27	r	
168	Steadly	Mich.	1888	s	April 27	r	Late.
169	Stevens Late	Del.	1890	s	April 27	r	
170	Stevens (R. Ripe)	Del.	1890	s	April 27	r	
171	St. John	Del.	1890	s	April 27	g	Early; yellow.
172	Strong (Mam.)	Mo.	1892	s	April 30	r	
173	Stump (the World)	Mo.	1890	s	April 27	g	
174	Summer Snow	Mich.	1894			r	
175	Surpasse (Neal)	N. Y.	1890	s	April 28	r	
176	Switzerland	Mich.	1890	s	April 28	g	Hardy.
177	Tallman 1	Mich.	1894				In bud only.
178	Tallman 2	Mich.	1894				In bud only.
179	Tallman 3	Mich.	1894				In bud only.
180	Toledo	Mich.	1894			r	

PEACHES.—CONCLUDED.

Number.	Name.	Origin.	Planted.	Flowers—l, large; s, small.	Date of bloom.	Glands—g, globose; r, reniform; s, serrate.	Remarks.
181	Toquin	Mich.	1892	l	April 30	g	Market.
182	Townsend	Mich.	1892	s	April 30	g	
183	Troth	Mo.	1890	s	April 27	g	Early market.
184	Tuskena, cling	Mo.	1892			r	
185	Wager	Del.	1890	l	April 30	r	
186	Walker	Mo.	1892	s	April 30	r	
187	Walker Var.	Mo.	1890	s	April 27	g	
188	Washington	Mo.	1890	s	April 28	g	
189	Waterloo	N. Y.	1888	s	April 29	r	
190	Wheatland	N. Y.	1888	s	April 28	g	Unproductive.
191	Willett	Mich.	1894			g	
192	Williamson	Mich.	1892	s	April 30	g	
193	Wonderful	N. J.	1890	s	April 30	r	Very late.
194	Worthen (Jennie)	Tex.	1892	s	April 30	r	
195	Yellow Rareripe	Mich.	1888	s	April 27	g	

The following descriptions refer to the fruits only. The peculiarities of foliage and blossoms are given in the foregoing tables. The letters b, m, and e represent the beginning, middle, and end of the month respectively. Size is given upon the scale, 1 to 5, reckoning from one downward.

Abricotee, ripe m. e. September. Size, 2. Form roundish oval; suture slight, half around the fruit; color yellow, sometimes faintly red in the sun; flesh yellow, with faint red at the pit—lacks juice; mild, vinous, pleasant; a market peach. Pit small, free. Fruit received for identification from Ohio and also from South Haven, and identified as above by the Division of Pomology.

Albright was received from New Jersey under the name Good. Ripe b. October. Size 1–2; form roundish, compressed toward the suture, which is distinct two thirds around, one side enlarged; color creamy white, dappled with red; flesh white, with a tinge of red at the pit; juicy, mild, not rich, free; quality 3 to 4.

Amsden, ripe July 27; size 3 to 4; form round; suture half around; color greenish with a red cheek; flesh pale greenish, adhering to the whitish pit; flavor mild vinous, pleasant; quality 3 to 4; skin with little pubescence; inclined to rot before ripening.

Barber (Syn. Hinman), ripe e. September; size 1 to 2; form irregularly oval, much compressed next the suture, which is distinct half around, enlarged on one side; color rich yellow, shaded and dappled with red; flesh bright yellow, red at the pit; juicy, mildly vinous, rich, pleasant; free; pit long, oval, small; market.

Bequette, cling, ripe b. m. September; size 1 to 2; form round, slightly elongated; suture distinct, half around; color creamy white, slightly washed or marbled red; flesh white, red at the pit; tender, juicy, mildly vinous, pleasant; quality 3; an attractive-looking peach.

Bequette, free, ripe m. e. September; size 2; form round; suture distinct, half around; color yellow, with faint red in the sun; flesh yellow, red at the pit; very juicy, mild vinous, pleasant; quality 3; market.

Bishop, ripe August 23; size 3; form roundish, depressed; color creamy yellow, shaded with rather dark red; flesh white, faintly reddened at the pit, from which it separates freely; very juicy, tender, sweet, rich; quality 1; a superior amateur variety; also for market, if sufficiently productive.

Blood Leaf, ripe b. m. October; size 4; form roundish, compressed toward the suture, which is slight, extending half around, apex depressed; color greenish yellow or cream, with occasionally a faint red cheek; flesh moderately juicy, mild, poor in flavor; white to the pit, which is large, adherent; quality 5; a curiosity, on account of the persistent brownish red color of the foliage.

Boyles, ripe m. September; size 2 to 3; form round, depressed, suture a mere line, more than half around, cavity very broad; color bright yellow, with a dark red cheek, pubescence slight; flesh yellow, faintly reddened at the pit, which is free; very juicy, tender, mildly vinous, rich, excellent; quality 1 to 2; table and market.

Brigdon, ripe September 2, size 5, (probably not a representative specimen) round, compressed toward the suture, color creamy yellow, with faint blush, flesh bright yellow, very juicy, mild, vinous, rich, free; quality 2; market.

Brown, ripe August 23, size 3, form roundish, suture two thirds around, color creamy, with red cheek; flesh, yellowish white; lacks juice; mild, pleasant; quality 4; free; pit small.

Burke, ripe m. September, size 1, form roundish, slightly elongated, suture very distinct, more than half around; color creamy, with a faint tinge of red; flesh whitish, very red at the pit, exceedingly juicy, tender, vinous, pleasant, free; quality 2 to 3.

Canada (Syn. Early Canada), ripe July 28, though it scarcely equals the Amsden in size, is so much like it in all essential particulars that further notice is omitted.

Champion, ripe August 28, size 2, form round, nearly regular, suture slight, two thirds around; color creamy white, mottled with red in the sun; flesh whitish, with slight streaks of red at the pit (which is of scarcely medium size), very juicy, with delicate texture, free; quality 2. Superior for the dessert.

Chinese, cling, ripe b. m. September, size 1, form roundish, a little elongated, suture half around; color pale yellow, flesh white, red at the pit, very juicy, tender, rather vinous, with something of the peculiar, bitter peach flavor. Cling; an exceedingly fine, rich-looking peach.

Chili (Hill's), ripe m. e. September, size 2 to 3, form roundish, inclining to oval, compressed, suture distinct, one side enlarged, color yellow, marbled with red in the sun, quite pubescent; flesh bright yellow, red at the pit, which is long and rather large, very mild, almost sweet, not very juicy, quality 3, free; market only.

Chili Seedling No. 2; ripe e. September; size 2; form round, oval, compressed, suture distinct, two thirds around; color yellow and dark red, striped or mottled, moderately pubescent; flesh yellow, moderately juicy, vinous, sprightly, rich; quality 2; free. A decided improvement on the old Chili. Market. Originator, C. Engle, Paw Paw, Michigan.

Chili Seedling No. 3, ripe m. September; from the same source as the preceding; is so similar to it that further description is deemed unnecessary.

Cleffey (Allen), ripe September 6; size 2 to 3; form roundish, suture slight, three fourths around; color bright yellow, shaded with light and

dark red; flesh bright yellow, slightly red at the pit, juicy, vinous, sprightly; free; quality 2 to 3; a good handler; market, if productive.

Conkling, ripe m. e. September; size 1 to 2; form round, slightly ovate, a little compressed, suture distinct half around; color creamy white, with red cheek, marked with darker red; flesh whitish, red at the pit, which is small and pointed, very juicy, tender, vinous, pleasant; quality 3. Dessert.

Crothers, ripe e. September; size 2; form roundish, slightly compressed, slightly ovate, suture indistinct; color greenish white, with a red, striped or marbled cheek; flesh white, red at the pit, juicy, vinous, rather pleasant; quality 3; pit medium, free.

Dennis, ripe b. m. September; size 3; form round, suture distinct half around; color clear bright yellow; flesh light yellow, firm, moderately juicy, not reddened at the pit, which is free; flavor sprightly, vinous, rich; quality 2; a fine canning peach; promising for market.

Early Barnard, ripe August 28; size 2 to 3; form roundish, suture prominent, half around; color rich yellow, nearly covered with dark red; flesh yellow, much reddened at the pit, which is free; juicy, tender, nearly sweet; quality 3; market. Fruit buds hardy; inclined to overbear; must usually be severely thinned to secure good-size fruit, and to prevent injury to the tree.

Early Crawford, ripe September 1; size 1 to 2; form roundish, compressed toward the suture, which extends two thirds around; color bright yellow, with a red cheek; flesh bright yellow, slightly red at the pit, which is large; free; very juicy, vinous, tender; quality 2; popular on account of size and general appearance. Liability to winter killing of fruit buds is its most serious defect.

Early Michigan, ripe August 27; size 2; form roundish, compressed toward the suture, which is rather deep, half around; color creamy, shaded with light red; flesh creamy white, very juicy, tender, vinous, sprightly, excellent; free; pit small. Nos. 15 and 16 of the originator, the former with globose and the latter with reniform glands, are being propagated indiscriminately, under this name, the difference in the fruit of the two being scarcely noticeable.

Early Silver, ripe August 29; size 2 to 3; form roundish oval, slightly compressed, suture distinct half around, apex slightly conical; color greenish cream; flesh white to the pit; free; flavor juicy, vinous, rich; tender, crisp; quality 2; excellent for canning.

Elberta, ripe b. m. September; size 1 to 2; form roundish oval, slightly compressed, suture distinct, more than half around; color yellow, with a red cheek; flesh yellow, red at the pit, which is rather large, separating freely; flavor juicy, slightly vinous; quality 2 to 3; market.

Engle (Mam.), ripe m. September; size 2; form roundish, suture very slight, half around; color yellow, red next the sun; flesh yellow, scarcely reddened at the pit, which is rather small, free; flavor sweet, juicy, rich, pleasant; quality 2; an excellent market peach.

Foster, ripe August 31; size 1 to 2; form round, one side enlarged, slightly compressed toward the suture, which is slight, two thirds around; color bright yellow, shaded with dark red; flesh bright yellow, slightly red at the pit, which is rather large, free; flavor juicy, vinous, tender, sprightly; much like Early Crawford both in tree and fruit; quality 2; market.

Fox, ripe e. September; size 3; form oval, irregular, suture slight, three fourths around, apex a swollen point; color creamy white, with a little bright

red next the sun; flesh white, with red at the pit; flavor very juicy, mild, vinous, rich, free; quality 1 to 2. A dessert peach of superior flavor.

Geary, ripe b. October; size 2; form round, slightly compressed, suture two thirds around; color creamy yellow, with a faint suspicion of red in the sun; free.

Gem Cling, ripe e. September b. October; size 2; form roundish, slightly oblate, suture distinct, one side enlarged, apex a depression in the suture; color light cream, with red blush in the sun; flesh whitish, red at the pit, moderately juicy, mild, almost sweet, firm; quality 2 to 3.

Gold Drop, ripe e. September b. October; size 3; form roundish, suture distinct, more than half around, one side enlarged; color rich, clear yellow, approaching orange on the exposed side; flesh yellow to the pit; flavor sweet, firm, juicy, a good handler; quality 2 to 3; market.

Gudgeon, ripe m. October; size 2 to 3; form round, suture shallow, one side enlarged, apex a slight interruption in suture; color greenish white, flesh white, faintly reddened at the pit; flavor moderately juicy, tender, vinous, pleasant for so late a fruit, free; quality 4, will doubtless be improved when in full bearing.

Haas, ripe August 24; size 3; form round, depressed, suture slight, ending in a depression at the apex; color creamy white, shaded and dappled with bright red in the sun; flesh tender, creamy white, very juicy, mildly vinous, free; quality 1 to 2.

Hale, ripe August 8; size 3; form round, suture slight, half around; color greenish white, with a red cheek, pubescence slight; flesh greenish white, partially adherent, very juicy, vinous, pleasant; quality 3; dessert, market.

Hale x oblong and Hale x round, are very nearly alike, and very similar to Hale, though less adherent and of finer flavor.

Hance Smock, ripe b. m. October; size 1 to 2; form round, suture distinct, half around, one side enlarged; color yellow, with red cheek; flesh yellow, red at the pit, which is of medium size, free; quality 3 to 4; market.

Hyatt, ripe August 8; size 2 to 3; form roundish, suture distinct; color pale, with rich, red cheek; flesh pale, rich, vinous, very good. Every way much like Hale, but more highly colored, of superior quality and, when fully ripe, nearly free from the pit; promising for both dessert and market.

Hynes, ripe August 21; size 4; color pale, mottled, shaded or striped red; form roundish, depressed, suture moderate, ending in a depression at the apex; flesh white, tender, very juicy, vinous, rich, nearly or quite free, when fully ripe; quality 2; dessert.

Infant Wonder, ripe September 3; form roundish, slightly oval, suture slight, two thirds around; color creamy white, with a little red in the sun; flesh white, with a little red at the pit, which is free; flavor highly vinous, juicy; quality 3 to 4.

Ingold, ripe August 20; size 4; color creamy, with red cheek; flesh pale, mildly vinous, very juicy, tender, free; quality 1 to 2; excellent for dessert.

June Rose, ripe September 4; size 4; form round, suture distinct, half around; color pale creamy white, blushed or marbled with light red; flesh white, faint red at the pit, which is free; very juicy, tender, vinous, excellent; quality 1; an admirable dessert peach.

Kallola, ripe m. September; size 2 to 3; form roundish oval, slightly compressed toward the suture, which is distinct, more than half around; color white, tinged red in the sun; flesh greenish white, faintly reddened at the

pit, which is free; tender, very juicy, vinous, rather rich, pleasant; quality 2; a very good dessert peach.

Lemon Cling, ripe e. September; size 3 to 4; form ovate, pointed at the apex, suture distinct, one side enlarged; color creamy, blushed red next the sun; flesh pale yellow, red at the pit; adherent; flavor rich, juicy, vinous, pleasant; quality 2 to 3.

Lewis, ripe August 25; size 2; form roundish, slightly depressed, suture half around, slight; color creamy white, shaded and marbled with two shades of bright red; flesh whitish, very juicy, tender, mildly vinous, pleasant; quality 2 to 3. A popular market peach; distinct from Early Michigan, with which it has been confounded, and scarcely its equal in quality.

Lovell, ripe m. e. September; size 4; form round, suture slight, half around; color clear yellow, with faint marbling of red; flesh yellow to the pit, which is free; firm, vinous, pleasant, moderately juicy; quality 4; market.

Lovett White, ripe b. m. October; size 1 to 2; form oval, cavity narrow, rather deep, suture distinct; color creamy white; flesh greenish-white to the pit, which is free; juicy, mild, vinous, not rich; quality 3; rather late for this latitude.

Magdala, ripe September 4; size 4; form round, suture very slight; color creamy white, with two shades of red; flesh white or yellowish white, with faint red at the pit, which is free; juicy, mild, vinous; quality 3; dessert.

Mammoth Heath, ripe b. October; size 2 to 3; form roundish oblate, suture distinct, two thirds around; color rich yellow, a little red near the stem; flesh clear yellow to the pit; juicy, firm, sweet, sprightly, rich; adherent; quality 2.

Marshall Late, ripe m. October; size 3; form irregular oval, suture distinct near the apex, which is sunken, one side much enlarged, especially near the apex; color yellow; flesh yellow, red at the pit, which is free; moderately juicy, and quite vinous; quality 3 to 4; needs further trial.

McCollister, ripe e. September b. October; size 2; form roundish oval, apex pointed, compressed toward the rather distinct suture, one side enlarged; color pale creamy yellow, with a bright red cheek, obscurely striped; flesh light yellow, red at the pit, which is free; juicy, mild, nearly sweet, pleasant; quality 2 to 3; pit medium, long, pointed; market.

Morris County, ripe m. October; size 2 to 3; form round, suture slight, half around, apex a mere speck in the suture; color light cream; flesh white, faintly reddened at the pit; moderately juicy, vinous, pleasant, free; quality 3 to 4.

Mountain Rose, ripe August 22; size 3; form round, suture slight, two thirds around, apex a depression in the suture; color creamy, with red in the sun; flesh creamy white, slightly red at the pit, which is free; juicy, slightly vinous, mild, pleasant, quality 2; dessert, market.

Mystery, ripe August 28; size 1; form roundish, slightly flattened, suture moderate, two thirds around; color bright yellow, with a dark red cheek; flesh bright yellow, tender, vinous, very juicy, free; quality 2; very beautiful, but so far a thin bearer.

Apricot (Syn. N. Am. Ap't.), ripe e. September; size 3; form roundish ovate, suture distinct, two thirds around; color yellow, with a faint tinge of red; flesh yellow, faint red at the pit; juicy, tender, vinous, pleasant; quality 3; free; an imperfect specimen.

Nectarine, ripe m. September; size 2 to 3; form ovate, pointed at apex, suture scarcely perceptible, half around; color pale cream, with a faint red marbled cheek, pubescence slight; flesh white, red at the pit, which is free; juicy, vinous, rich; quality 2; a dessert peach.

New Prolific, ripe b. m. September; size 3; form round, suture distinct, half around; color light cream, with a dark red cheek; pubescence slight; flesh yellow, juicy, sweet, rich; free, pit small; quality 2 to 3; a beautiful and good peach for dessert or market.

Oldmixon, cling, ripe m. September; size 2 to 3; form ovate, suture scarcely perceptible; color pale yellow; flesh creamy white, red at pit, adherent; mild, juicy, pleasant; quality 3.

Oldmixon, free, ripe b. m. September; size 2; form roundish, slightly elongated, suture slight, two thirds around; color creamy white, marbled with light red; flesh nearly white, with red at the pit; very juicy, vinous, pleasant, rich, excellent; quality 1.

Pearl, ripe b. m. September; size 2; form round, suture a mere line, half around; color creamy white, faintly marbled with red; flesh white, red at the pit, very juicy, vinous, tender, rich, free; quality 2, much like Oldmixon, free.

Picket late, ripe m. October; size 4; form roundish oval, suture indistinct, apex a slight interruption of the suture; color creamy with a dappled red cheek; flesh white, slightly brown at the pit, which is free; very firm, moderately juicy, mild, vinous; quality 5, needs further trial.

Pratt, ripe August 31; size 3; form roundish, compressed toward the suture which is distinct half around; color bright yellow with a dark red cheek; flesh yellow, red at the pit, which is large and free; flavor mild, vinous, rich, tender, moderately juicy; quality 3; apparently a desirable market peach.

Princess (of Wales), ripe m. e. September; size 1; form round, suture indistinct; color light cream, with light pink about the stem; flesh white, slightly red at the rather large pit, which is free; juicy, tender, vinous, rich; quality 1 to 2; a large, beautiful, and excellent dessert peach.

Prize 1, ripe e. September b. October; size 3; form roundish oblong, suture slight, half around, one side enlarged; color yellow, red at the pit, which is rather large, free; moderately juicy, vinous, rather rich, pleasant; quality 3; market.

Red Seedling (origin supposed to be at South Haven, Michigan), ripe August 24; size 3; form roundish, compressed toward the distinct suture; color creamy white, washed with red in the sun; flesh whitish, slightly red at the pit, from which it separates freely; quality 3.

Rivers, ripe August 3; size 2 to 3; form roundish oval, suture moderate; color pale cream, with a light pink cheek; flesh white to the pit, which is free; tender, delicate, vinous, rich, excellent; quality 1 to 2; dessert and market.

Roseville, ripe b. m. October; size 2; form round, suture slight half around, apex sunken; color creamy white, to the pit, to which it adheres; juicy, vinous, mild, rich; quality 2; one of the best late clings.

Salway, ripe m. October; size 2; form irregular, roundish, suture distinct, three fourths around, apex sunken; color creamy, slight red at the stem; flesh yellow, red at the pit, which is free; moderately juicy, vinous, pleasant; quality 3; may improve when more fully in bearing.

Scott (Nonpariel), ripe b. m. October; size 4; form round, suture slight, half around, apex sunken; color yellow, with a faint red cheek, very pubes-

cent; flesh yellow, red at the pit, which is free; rather dry, slightly acid, and bitter (noyeau), quality 4 to 5.

Shipley, ripe m. September; size 3; form roundish oval, suture not prominent; color pale, with a red cheek; flesh pale, moderately juicy, red at the pit, which is free; flavor vinous, rather tender, pleasant; quality 3; market, productive.

Smock free, ripe b. m. October; size 2; form roundish, slightly compressed toward the suture, which is distinct, one side enlarged; color yellow; flesh yellow, with red at the pit, which is large; flavor vinous, not very juicy, inclined to acid; quality 3; market.

Southern Early, ripe August 30; size 1 to 2; form roundish, slightly compressed, suture two thirds around; quite pubescent; color creamy white; flesh yellow, much reddened at the pit, which is free; texture fibrous; flavor vinous, not very rich, moderately juicy; quality 3.

Stark Heath, ripe m. October; size 2; form roundish oval, compressed toward the suture, which is distinct near the swollen apex, and one side much enlarged; color light, creamy; flesh white to the pit, which is adherent; firm, moderately juicy, mild; quality 3 to 4.

Steadly, ripe b. m. October; size 1 to 2; form oval, suture two thirds around, apex swollen; color creamy; flesh greenish white to the pit, which is free; lacks juice; vinous, tender, rich; quality 3; a thin bearer.

Stump, ripe August 23; size 2 to 3; form roundish oblong; color whitish, with a red cheek; flesh pale, vinous, juicy, free; received from Missouri as Heath Cling.

Switzerland, ripe m. e. September; size 3; form round, suture scarcely perceptible, two thirds around; color creamy, marbled with red in the sun; flesh whitish, red at the pit, which is free; juicy, nearly sweet, pleasant, not rich; quality 3; a market peach.

Toquin, ripe m. e. September; size 3; form round, suture indistinct, half around; color bright yellow, with sometimes a faint tinge of red; flesh yellow, faintly reddened at the pit, which is small and free; moderately juicy, vinous, sprightly, rich, firm; quality 3; a promising market peach, originating in the town of Toquin, Michigan.

Troth, ripe September 1; size 4; form round, suture slight, two thirds around; color creamy white, shaded with dull red in the sun; flesh creamy white, tender, moderately juicy, mild in flavor; quality 4; free; an old, productive market variety.

Wager, ripe b. October; size 4 to 5; form roundish, slightly elongated, suture distinct, more than half around; color pale yellow, with a red cheek; flesh pale yellow, rather dry, vinous, rather rich; quality 3 to 4; market.

Walker Variegated, ripe e. September; size 2 to 3; form roundish, suture distinct, two thirds around, apex slightly swollen; color creamy white, with red cheek; flesh white with red at the pit, which is free; juicy, mildly vinous, pleasant; quality 3; a dessert peach.

Wheatland, ripe September 4; size 1+; form round, suture slight, three fourths around; color whitish, shaded with red in the sun; flesh whitish, red at the pit, which is free; tender, juicy, vinous; quality 3; a market peach where sufficiently productive, but, unfortunately, unproductive in most localities.

Wonderful, ripe b. October; size 1; form roundish, slightly oval, suture distinct, two thirds around, one side enlarged; color greenish yellow, with a faint red cheek; flesh yellow, with red at the pit, which is free; moderately

juicy, rather acid, slightly bitter; quality 5; too late to acquire flavor in this climate.

Worthen (Jennie), ripe b. m. September; size 3 to 4; form roundish, compressed toward the rather prominent suture, which extends more than half around; color yellow, with a red cheek; flesh yellow, with red at the pit, which is free; juicy, vinous, not rich; quality 5; so far not desirable.

Yellow Rareripe, ripe August 28; size 3; form roundish, suture moderate, two thirds around, one side enlarged; color yellow, with red in the sun; flesh yellow, reddened at the pit, which is free; fibrous, very juicy, vinous, sprightly; quality 3; a market fruit.

APRICOTS (*Armeniaca vulgaris.*)

Owing to its very early season of blooming, and its liability to the depredations of the curculio, this fruit is rarely planted in Michigan. A single recent variety only (the Harris), an American seedling, of the type usually designated as European, which has been found successful in central New York, has been planted here the past spring, although several of the varieties more commonly known as "Russian" have been on trial here for several years, with but ill success, none of them, so far, having shown fruit.

They have been treated, by spraying, for insects and fungi, in connection with peaches, to which section the reader is referred for such information.

NECTARINES (*Persica vulgaris*).

This is usually considered to be merely a smooth-skinned variety of peach, it being a well-authenticated fact that nectarines have originated from peach seed, and vice versa.

For remarks respecting insects, fungi, and spraying, reference is made to the section on peaches.

Pitmaston Orange, planted in 1892; glands reniform; not yet bloomed or fruited; appears to be deficient in vigor.

Seedling originated here, from Michigan-grown seed; ripe b. September; size 5 (as compared with peaches), form round, slightly ovate; suture slight, half around; color whitish, washed and marbled with dark red; flesh white, reddened at the pit, which is free; highly vinous, juicy, rather rich; quality 4. Too poor to be recommended, except for hardiness.

GRAPES (*Vitis*).

Although the season's crop of grapes, of many if not most varieties, has been comparatively light, few of either insects or fungi have been specially troublesome.

An occasional rose chafer (*Macrodactylus subspinosus*) has been discovered, and of course, at once destroyed.

The only other insect numerous enough to demand special attention is a black aphis (*Siphonophora viticola*, Thomas), which appeared in large numbers upon the young, tender canes and foliage, but yielded to a thorough spray of strong tobacco water.

GRAPES.

Alphabetical tabulation.

Number.	Name.	Origin.	Planted.	Bloom.	Ripe.	Remarks.
1	Adirondac	N. Y.	1890	June 20	Aug. 31	Not successful.
2	Agawam	Mass.	1888	" 18	Sept. 14	A long keeper.
3	Aminia	Mass.	1888	" 19	" 14	Good; market.
4	August Giant	N. Y.	1889	" 23	" 15	Large; showy.
5	Barry	Mass.	1888	" 18	" 14	A Rogers hybrid.
6	Beagle	Tex.	1889	" 19		A Munson seedling.
7	Bell	Tex.	1889	" 16	Sept. 15	A Munson seedling.
8	Belvidere	Ill.	1892	" 22		Further trial.
9	Berckmans	S. C.	1892	" 16	Sept. 15	New; promising.
10	Berlin	Mich.	1893			Not yet fruited.
11	Black Eagle	N. Y.	1890	June 20	Sept. 20	A *vinifera* hybrid.
12	Black Pearl	Ohio	1890	" 20		Not yet fruited.
13	Blanco	Tex.	1889	" 20	Sept. 15	From Texas.
14	Brighton	N. Y.	1888	" 19	" 8	Very high quality.
15	Brilliant	Tex.	1889	" 22	" 15	Yet on trial here.
16	Burnett	Ont.	1891	" 20		Try further.
17	Cambridge	Mass.	1890	" 20		Try further.
18	Campbell	Tex.	1889	" 19	Sept. 20	Better at the South.
19	Catawba	N. C.	1888	" 19	Oct. 15	Very late.
20	Cayuga	N. Y.	1889	" 16	Sept. 20	Worthy of trial.
21	Caywood (50)	N. Y.	1888	" 19	" 15	A market grape.
22	Centennial	N. Y.	1890	" 23		Inclined to mildew.
23	Challenge	N. J.	1890	" 21		Not well tested.
24	Champion	N. Y.	1889	" 19	Sept. 20	Indifferent.
25	Chidester (3)	Mich.	1892	" 20		Partially tested.
26	Chidester (4)	Mich.	1892	" 20		Partially tested.
27	Clark	D. C.	1892			Not fruited.
28	Clevener	N. Y.	1890	June 20		Not fully tested.
29	Clinton	N. Y.	1891	" 16		A frost grape.
30	Colerain	Ohio	1892	" 24		But partially tested.
31	Columbia	D. C.	1891			Mildews badly.
32	Concord	Mass.	1888	June 19	Sept. 14	The staple for market.
33	Cortland	N. Y.	1890	" 20		New; early.
34	Cottage	Mass.	1890	" 19	Sept. 20	Old; not valued.
35	Crevelling	Penn.	1890	" 18		Unproductive.
36	Delaware	N. J.	1888	" 16	Sept. 18	Small; excellent.
37	Diamond	N. Y.	1889	" 20	" 14	Valuable.
38	Diana	Mass.	1888	" 19	Oct. 10	A long keeper.
39	Downing	N. Y.	1889	" 19	" 1	Worthy of trial.
40	Dracut	Mass.	1890	" 23		Of no value.
41	Duchess	N. Y.	1888	" 19	Oct. 12	Excellent; uncertain.
42	Early Market	Tex.	1889	" 19	Sept. 15	Not desirable here.
43	Early Victor	Kan.	1888	" 20	" 7	New; on trial.
44	Eaton	Mass.	1888	" 19	" 12	Like Concord.
45	Elaine	Mich.	1889	" 20		Partially tested.
46	El Dorado	N. Y.	1889	" 19		An amateur grape.
47	Elvira	Mo.	1890	" 20		Too far north.
48	Empire State	N. Y.	1888	" 18	Sept. 25	Good; amateur.
49	Essex	Mass.	1889	" 23		A Rogers hybrid.
50	Esther	Mass.	1890	" 21		New; on trial.
51	Etta	Mo.	1890	" 20		Seldom planted.
52	Eugenie	N. Y.	1891			Mildews badly.
53	Eumelan	N. Y.	1888	June 19	Sept. 14	Worthy.
54	Eva	Penn.	1889	" 16	" 15	Not valuable.
55	Excelsior	N. Y.	1889			Untested.
56	Faith	Mo.	1891	June 20		A wine grape.
57	Gaertner	Mass.	1889	" 23	Oct. 1	Rogers hybrid.
58	Geneva	N. Y.	1891	" 20		Not fruited.
59	Goethe	Mass.	1889	" 16		Rather late.
60	Golden Drop	N. Y.?	1889	" 19		A feeble plant.

GRAPES—CONTINUED.

Number.	Name.	Origin.	Planted.	Bloom.	Ripe.	Remarks.
61	Golden Gem	N. Y.	1890			Not yet tested.
62	Guinevra	Mich.	1891	June 21		C. Engle seedling.
63	Hall	Mich.	1893			New; early.
64	Hartford	Conn.	1889	June 20	Aug. 30	Poor quality.
65	Hayes	Mass.	1888	" 18	Sept. 16	Francis B. Hayes.
66	Herbert	Mass.	1889	" 24	" 15	Rogers hybrid.
67	Highland	N. Y.	1889	" 23	Nov. —	Too late.
68	Honey	Mich.	1891			C. Engle seedling.
69	Hosford	Mich.	1893			Origin, Ionia.
70	Iona	N. Y.	1888	June 20	Sept. 16	Usually a failure.
71	Iris	Mich.	1891	" 22	" 20	C. Engle seedling.
72	Isabella	S. C.	1888	" 20	" 18	Oldest American.
73	Ives	Ohio	1890	" 18	" 30	A wine grape.
74	Janesville	Wis.	1890	" 16	" 7	Very hardy.
75	Jefferson	N. Y.	1888	" 16	Oct. 1	Late keeper.
76	Jessica	Ont.	1888	" 20	Sept. 8	Quite seedy.
77	Jewell	Kan.	1889	" 16	" 7	Seedling by Burr.
78	Josselyn (5)	N. Y.	1890	" 20		Not yet named.
79	Josselyn (7)	N. Y.	1890	" 26		Not yet named.
80	Josselyn (9)	N. Y.	1890	" 26		Not yet named.
81	Josselyn (10)	N. Y.	1890			Not yet named.
82	Lady	Ohio	1888	June 18	Sept. 8	Early; hardy.
83	Leader	Ohio	1890	" 23		Not well tested.
84	Leavenworth	Kan.	1890	" 20		Not tested.
85	Lindley	Mass.	1889	" 19	Sept. 30	Rogers hybrid.
86	Lutie	Tenn.	1890	" 20	" 20	Utterly worthless.
87	Mason	Mich.	1891			Not yet fruited.
88	Massasoit	Mass.	1888	June 19	Sept. 18	Rogers hybrid.
89	Merrimac	Mass.	1888	" 19	" 16	Rogers hybrid.
90	Michigan	Mich.	1889	" 20	" 15	C. Engle seedling.
91	Millington	N. Y.	1891	" 20		Not disseminated.
92	Mills	Ont.	1888	" 20	Oct. 15	Vinifera hybrid.
93	Minnesota	Minn.	1890			Doubtful value.
94	Monroe	N. Y.	1889	June 23		Origin, Rochester.
95	Moore Early	Mass.	1888	" 19	Sept. 3	Concord seedling.
96	Moyer	Ont.	1888	" 19	" 4	Imperfect clusters.
97	Naomi	N. Y.	1889	" 16	Oct. —	Rickett's seedling.
98	Nectar	N. Y.	1888	" 20	Sept. 15	A. J. Caywood.
99	Niagara	N. Y.	1888	" 20	" 12	Origin, Lockport, N. Y.
100	Northern Light	Ont.	1890	" 19	" 15	Promising.
101	Olita	Tex.	1889	" 23		T. V. Munson.
102	Oneida	N. Y.	1890	" 20		Little known.
103	Osage	Kan.	1890	" 23		Little known.
104	Owosso	Mich.	1890	" 22		Origin, Owosso.
105	Ozark	Kan.	1890	" 21		Not well tested.
106	Peabody	N. Y.	1890	" 20		Little known.
107	Perkins	Mass.	1889	" 19	Sept. 1	Low in quality.
108	Pocklington	N. Y.	1888	" 16	" 17	Showy; too foxy.
109	Poughkeepsie	N. Y.	1888	" 19	" 16	Plant lacks vigor.
110	Prentiss	N. Y.	1888	" 20	" 15	Lacks hardiness.
111*	Pres. Lyon (Chidester)	Mich.	1888	" 16	" 14	Very shy bearer.
112†	Pres. Lyon (Munson)	Tex.	1889	" 19		Mildews badly.
113	Progress	Kan.	1890	" 26		Not fully tested.
114	Pulpless	Mich.	1892	" 21		C. Engle seedling.
115	Rentz	Ohio	1889	" 24		Not desirable.
116	Requa	Mass.	1890	" 23		Rogers hybrid.
117	Rochester	N. Y.	1890	" 20		Ellwanger & Barry.
118	Rockwood	N. Y.?	1890			Not yet fruited.
119	Rogers (5)	Mass.	1889	June 19	Sept. 30	Rogers hybrid.
120	Rogers (8)		1889	" 22	" 30	Rogers hybrid.

* It is understood that, owing to its extreme and persistent lack of productiveness, this grape has not been, and probably will not be, offered for sale.
† This grape is now re-named *Presly* by the originator, T. V. Munson of Texas.

GRAPES—CONTINUED.

Number.	Name.	Origin.	Planted.	Bloom.	Ripe.	Remarks.
121	Rogers (24)		1889	June 23		Rogers hybrid.
122	Rogers (30)		1889	" 24	Aug. 30	Rogers hybrid.
123	Rommell	Tex.	1889	" 19		Better South.
124	Salem	Mass.	1888	" 19	Sept. 15	Rogers hybrid.
125	Secretary	N. Y.	1890	" 21	" 15	Not successful.
126	Telegraph	Penn.	1890	" 20	" 20	Old variety.
127	Themis	Mich.	1891			C. Engle seedling.
128	Triumph	Ohio	1890	June 23		Too late.
129	Ulster	N. Y.	1888	" 19	Sept. 14	By A. J. Caywood.
130	Vergennes	Ver.	1890	" 16	" 14	A good keeper.
131	Vesta	Mich.	1891	" 20		C. Engle seedling.
132	Victoria	N. Y.	1890	" 23	Oct. 1	Which one?
133	Warder	Ill.	1892	" 23		Not fruited.
134	Washington (Lady)	N. Y.	1888	" 20	Oct. 10	Showy; rather late.
135	Wells	Mo.	1890	" 20	Sept. 30	Little known.
136	White Ann Arbor	Mich.	1888	" 19		Not promising.
137	White Beauty	Kan.	1890	" 23		Not well tested.
138	White Imperial	Kan.	1890	" 20		Not well tested.
139	Wilder	Mass.	1888	" 19	Sept. 14	Rogers hybrid.
140	Willis	Ill.	1890	" 22		Not tested.
141	Winchell	Ver.	1889	" 19	Sept. 5	Best early white.
142	Witt	Ohio	1889	" 16	" 20	Little known.
143	Woodruff	Mich.	1888	" 19	" 18	Very variable.
144	Worden	N. Y.	1888	" 19	" 8	Early; valuable.
145	Wyoming	N. Y.	1888	" 19	" 14	Poor quality.

The extremely dry season has apparently been unfavorable to the development of fungi, from which but little trouble has been experienced.

The grapes upon the place were thoroughly sprayed with Bordeaux mixture in autumn of last year, soon after pruning.

They received no further application until May 17, when they were treated with Bordeaux mixture, with a little Paris green.

July 7 to 9, grapes were again sprayed with Bordeaux, using four pounds copper sulphate and three pounds stone lime, in forty gallons of water.

July 16 and 17, applied a spray of tobacco water for aphides.

The pruning of grapes in autumn was somewhat delayed, on account of the persistence of the foliage, due to the absence of frost and possibly to the moist weather following the severe drouth.

In the following descriptions of varieties, for the sake of brevity the following abbreviations and numerals are employed:

b. beginning, m. middle, e. end of the month.

The size, whether of bunch or berry, is indicated by numbers, upon the scale of 1 to 5; 1+ representing very large and 5— very small. The same scale is also employed to indicate quality.

The number of seeds in a berry is also expressed in numerals; as, 1 to 2; 3 to 4, etc.

Adirondac, ripe e. August, b. September; size bunch 1, berry 1; form, long, conical, compact, occasionally shouldered; berry roundish oval; color black; bloom slight, bluish; flesh tender, mild, vinous, sprightly, pleasant; quality 1 to 2, plant not vigorous; subject to mildew.

Agawam, ripe e. September, b. October; size bunch 2 to 3, berry 1; form, bunch long, rather loose, berry roundish, slightly oval; color dark red; bloom

bluish; flesh greenish, juicy, vinous, sprightly, pulp half tender; seeds large, 1 to 2; quality 2 to 3; a long keeper.

Aminia, ripe m. September; size, bunch 3, berry 1; form, bunch roundish oblong, moderately compact, shouldered; berry round or roundish oval; color black with grayish bloom; flesh greenish white, juicy, pulp tender, very pleasant; seeds 1 to 3, very large; quality 2 to 3; well adapted to the market.

August Giant, ripe b. m. September; size bunch 1—, berry 1—; form, bunch very long, often shouldered; berry oval or oblong; color black; bloom grayish; flesh juicy, high flavored, vinous, pulp half tender; seeds large 1 to 4; quality 2 to 3.

Barry, ripe m. e. September; size, bunch 2 to 3—, berry 2; form, bunch short, compact, shouldered; berry round; color black; bloom blue; flesh greenish, moderately juicy, vinous, sprightly, pulpy; seeds 1 to 3; quality 3; inclined, like several of the Rogers grapes, to set many small, imperfect clusters.

Beagle, ripe b. m. September; size, bunch 4, berry 3; form, bunch long, cylindrical, loose; berry round; color black; bloom slight, blue; flesh greenish, moderately juicy, vinous, pulp half tender, rather rich; seeds 2 to 3; quality 3. A seedling by T. V. Munson of Texas.

Bell, ripe m. e. September; size, bunch 3, berry 3; form, bunch oblong or cylindrical, loose, berry round; color greenish with whitish bloom; flesh greenish, juicy, vinous, rich, pulp tender; seeds 1 to 3; quality 1; a table grape originated by Munson of Texas.

Berckmans, ripe m. e. September; size, bunch 3 to 4, berry 3 to 4; form, bunch cylindrical compact, berry round; color dark wine, with slight bluish white bloom; skin thin; juice abundant, colorless; seeds medium size, 1 to 3; pulp tender; flavor vinous, sprightly; quality 1; first bearing, bunches imperfect; table; a cross between Clinton and Delaware.

Black Eagle, ripe m. e. September; size, bunch 1, berry 2; form long, shouldered, moderately compact; berry roundish oval; color black; bloom slight, blue; flesh greenish, lacks juice, vinous, high flavored, pulp tender; seeds 2, large; quality 4; said to be of superior quality further south.

Blanco, ripe m. September; size of berry 4; form round; color white, with whitish bloom; flesh white, juicy, sweet, pulp tender, breaking; seeds 1 to 2; quality 3. Originated by Munson of Texas.

Brighton, ripe m. September; size, bunch 1 to 2, berry 1 to 2; form, bunch long, moderately compact, shouldered; berry round; color dark wine, nearly black when fully ripe; bloom lilac; flesh very juicy, vinous, rich, excellent, pulp tender; seeds 1 to 2; quality 1; productive when planted adjacent to others to insure pollination.

Brilliant, ripe m. September; size, bunch 1 to 2; berry 1 to 2; form, bunch cylindrical, inclined to conical, shouldered, compact; berry round; color dark wine, nearly black when fully matured; flesh whitish, juicy, vinous, rich, pulp tender; seeds 2 to 3; quality 1 to 2; a cross of Delaware upon Lindley, by T. V. Munson of Texas.

Cambridge, ripe m. October; size, bunch 1, berry 2; form, bunch shouldered, berry round; color black; bloom blue; flesh white, juicy, vinous, sprightly, pulp tough; seeds large, 1 to 3; quality 3. Identity uncertain.

Campbell (now renamed Early Golden), ripe m. e. September; size, bunch 3, berry 3; form, bunch cylindrical, berry slightly oval; color yellow; bloom slight; flesh whitish, moderately juicy, vinous, pulp tender; seeds 1 to 2. Originated by T. V. Munson, Texas.

Catawba, scarcely ripe m. October; size, bunch 2, berry 2; form, bunch long, loose, shouldered; berry round; color deep red; bloom lilac; flesh whitish, juicy, highly vinous, rich, pulp tough; seeds large, 1 to 4; quality 2. Scarcely ripe when tested, October 10; not sure to ripen in this climate.

Cayuga, ripe b. September; size, bunch 4, berry 2 to 3; form, bunch long, moderately compact; berry round or oval; color black; bloom light blue; flesh juicy, pulp whitish, very tender, vinous, pleasant; seeds 2 to 3; quality 2; plant moderately vigorous.

Caywood, ripe m. September; size, bunch 3, berry 2 to 3; form, bunch roundish, elongated, berry slightly ovate; color black, with slight grayish bloom; flesh juicy, slightly vinous, pulpy; seeds large, 2 to 3; quality 3 to 4. Received from the late A. J. Caywood as No. 50. Both plant and fruit seem adapted to market uses.

Centennial, ripe e. September; size, bunch 2 to 3, berry 3; form, bunch conical, compact, berry round; color white, with a tinge of red; bloom grayish; flesh whitish, juicy, vinous, sprightly, pulp tender; seeds 1 to 2; quality 2; plant lacks vigor, and is inclined to mildew.

Champion, ripe August; size, bunch 2, berry 3; form, bunch shouldered, compact, berry round; color black; flesh greenish, moderately juicy, vinous, poor; seeds many, large; quality 5. Too poor in quality for any purpose.

Concord, ripe m. e. September; size, bunch 2, berry 2; form, bunch cylindrical, shouldered, moderately compact; berry round; color black; bloom blue; flesh greenish white, juicy, vinous, sprightly, pulp half tender; seeds large, 1 to 3; quality, 3 to 4; generally valued for market.

Cottage, ripe b. m. September; size, bunch 2, berry 3; form, bunch moderately compact, cylindrical, shouldered; berry round; color black; bloom blue; flesh pale, juicy, sweet, foxy, pulp rather tough; seeds large, 2 to 3; quality 6. Thought by some persons to be superior in quality to its parent, the Concord.

Delaware, ripe m. e. September; size, bunch 3, berry 3 to 4; form, bunch nearly cylindrical, very compact, shouldered; berry round; color red, very dark at full maturity; bloom slight, bluish; flesh greenish white, vinous, rich, sprightly, excellent; pulp tender, quality 1. With suitable soils and good management fully as productive as Concord and even more profitable.

Diamond, ripe b . m. September; size, bunch 1, berry 1; form, bunch long, shouldered, moderately compact; berry round; color greenish white; bloom whitish; flesh greenish white, juicy, vinous, pulp tender; seeds 2 to 4; quality 2; a superior medium early grape.

Diana, ripe e. September; size, bunch 3, berry 2 to 3; form, bunch short, cylindrical, very compact, berry round; color light wine; bloom light gray; flesh whitish; mild, vinous, pleasant, foxy; skin thick, tough; seeds rather large, 1 to 2; quality 2 to 3; a long keeper. The foxy odor disappears when kept.

Downing, ripe e. September; size, bunch 1+; berry 1+; form, bunch long, conical, compact, slightly shouldered; berry oval; color black; bloom blue; flesh whitish, juicy, vinous; pulp tender; skin thick, but rather tender; seeds large, generally but one; quality 1 to 2; especially valuable as a long keeper. Although of partially *vinifera* parentage, so far it has been unusually free from mildew, and quite productive.

Duchess, ripe e. September, b. October; size, bunch 1, berry 2 to 3; form, bunch long, shouldered, compact; berry round; color pale green; bloom

whitish; flesh greenish, juicy, vinous, pulp tender, rich; seeds 1 to 2; quality 1; of partially *vinifera* parentage, and not always reliable.

Early Market, ripe m. September; size, berry 4; form, berry round; color black; bloom bluish; flesh colorless, moderately juicy, pulp tender; seeds 2 to 3; flavor mild, sprightly; quality 3; a Texas seedling not promising here.

Early Victor, ripe b. m. September; size, bunch 3, berry 3; form, bunch oblong, conical, compact, shouldered; berry round; color black, with pale bluish bloom; flesh juicy, vinous, pulpy, rather rich, pleasant; seeds 2 to 3; quality 2 to 3.

Eaton, ripe e. September, b. October; size, bunch 1 to 2, berry 1+; form, bunch medium length, shouldered; berry round; color black; bloom blue; flesh greenish white, juicy, vinous, pulpy; quality 4; market: larger than Concord but not as desirable.

Empire State, ripe e. September, b. October; size, bunch 1 to 2, berry 2; form, bunch cylindrical, shouldered, compact; berry round; color light green, with slight whitish bloom; flesh light green, very juicy, vinous, pleasant, pulp tender; seeds 2 to 3; quality 1 to 2; table.

Essex, ripe b. m. October; size bunch 3, berry 1; form, bunch medium length, compact, shouldered; berry roundish, slightly oval; color reddish black; bloom slight, bluish; flesh pale, greenish, sweet, sprightly, pulp tender; seeds large, 2 to 3; quality 2 to 3.

Esther, ripe m. e. September; size, berry 2; form, berry round; color whitish; bloom white; flesh juicy, vinous, rich, pulp rather tough; seeds 1 to 2, large; quality 3.

Etta, ripe m. October; size, bunch 3, berry 3; form, bunch conical, compact, shouldered, berry round; color light green; bloom whitish; flesh greenish, juicy, acid; pulp very tender; seeds 1 to 2; quality 4 to 5; a wine grape; unworthy in this climate.

Eumelan, b. September; size, bunch 2 to 3, berry 2 to 3; form, bunch long, rather loose, shouldered, berry round; color black; bloom blue; flesh pale, greenish, juicy, vinous, sprightly, rich; seeds 2; quality 2; a partial failure in some soils and localities.

Eva, ripe m. e. September; size, bunch 3, berry 2 to 3; form, bunch conical, compact, shouldered, berry round; color pale green; bloom slight, whitish; flesh juicy, vinous, foxy, pulp rather tough; seeds 2 to 3; quality 3 to 4; much like Martha; not desirable.

Guinevra, ripe b. October; size, bunch 1, berry 1; form, bunch long, compact, berry oval; color greenish white; bloom slight, whitish; flesh greenish white, pulp half tender; seeds large, 1 to 3; quality 3; a seedling by C. Engle, Paw Paw, Michigan.

Hartford, ripe e. August; size, bunch 1, berry 2 to 3; form, bunch long, rather compact, shouldered, berry round; color black; bloom blue; flesh whitish, vinous, foxy, poor, pulp rather tough; quality 5; drops from the bunch as soon as ripe. Nearly superseded.

Hayes, ripe m. September; size, bunch 2 to 3, berry 3; form, bunch cylindrical, shouldered, compact, berry round; color greenish or yellowish white; bloom light; flesh juicy, mild, vinous, rich, pulp rather tough; seeds small, 1 to 2; quality 2 to 3. Table, market.

Herbert, ripe m. e. September; size, bunch 1 to 2, berry 1; form, bunch roundish, long, shouldered, moderately compact, berry round; color black; bloom blue; flesh greenish, juicy, tender, sweet, pleasant, pulp half tender; seeds large, 1 to 3; quality 2; desirable for either table or market.

Highland, ripe e. October, b. November; size, bunch 1, berry 1; form, bunch long, rather loose, heavily shouldered, berry round; color black; bloom blue; flesh faint greenish white, juicy, sweet (when fully ripe, which is rarely the case here), pulp tender; seeds large, 1 to 2; quality 3; quite too late for the climate of Michigan.

Iona, ripe m. e. September; size, bunch 1, berry 3; form, bunch long, loose, shouldered, berry oval; color dark wine; bloom slight, bluish white; flesh pale greenish white, very juicy, highly vinous, excellent, pulp very tender; quality 1; the standard of excellence where it succeeds, but must have suitable soils and judicious treatment.

Isabella, ripe m. e. October; size, bunch 1, berry 1 to 2; form, bunch long, rather loose shouldered, berry oval; color black; bloom blue; flesh juicy, vinous, sweet, pulp half tender, seeds 1 to 4; quality 2; it needs a favorable location to always fully mature in the climate of southern Michigan.

Ives, ripe e. September; size, bunch 1 to 3, berry 3; form, bunch medium, compact, shouldered, berry slightly oblong; color black; bloom blue; flesh juicy, sweet, foxy, pulpy; productive. Mainly valued as a wine grape. It colors early, but matures later than Concord.

Janesville, ripe b. m. September; size, bunch 3, berry 2; form, bunch short, very compact, shouldered, berry round; color black; bloom slight, blue; skin thin, pulp moderately tender; flesh juicy, highly vinous; seeds large, 2 to 5; quality 4. Valued for vigor and hardiness.

Jefferson, ripe e. September b. October; size, bunch 2, berry 1 to 2; form, bunch short, compact, shouldered; berry round; color dark wine; bloom slight, blue; flesh whitish, juicy, sprightly, vinous, pulp tender; skin thick; seeds rather large 2 to 4; quality 1 to 2; very productive; a long keeper.

Jewel, ripe b. m. September; size bunch 4 to 5, berry 3 to 4; form bunch —, berry round; color black; bloom blue; flesh juicy, whitish, pulpy, vinous; seeds 1 to 4; quality 3.

Josselyn 5, ripe e. September, b. October; size, berry 1 to 3; form, berry round; color white; bloom white; flesh whitish, slightly acid (scarcely ripe), pulp rather tough; seeds 1 to 3; quality 3.

Josselyn 7, ripe e. September, b. October; size, bunch 3, berry 3; form, bunch cylindrical, rather loose, shouldered; berry round; color pale green; bloom sparse, whitish; flesh pale, greenish, juicy, vinous, rather rich, pulp half tender; seeds small, 1 to 2; a promising table grape.

Josselyn 9, ripe e. September, b. October; size, berry 2; form, berry round; color black; bloom bluish gray; flesh juicy, highly vinous, pulp very tender; seeds 1 to 2; quality 4; shells from bunch as soon as ripe.

Lady, ripe b. September; size, bunch 3, berry 2; form, bunch cylindrical, moderately compact; berry round; color light greenish yellow; bloom slight, whitish; flesh whitish, juicy, vinous, slightly foxy, pulp tender; seeds small, 2 to 3; quality 2 to 3.

Lindley, ripe e. September; size, bunch 3, berry 1 to 2; form, bunch long, loose, shouldered; berry round; color brick red; bloom slight, blue; flesh juicy, vinous, very pleasant, pulp tender; seeds large, 1 to 4; quality 2; valuable.

Lutie, ripe m. September; size, bunch 3, berry 1; form, bunch short, broad; berry round; color dark, dull amber; bloom light; flesh pale, juicy, sweet, very foxy, pulp half tender; seeds 1 to 2; quality 5; utterly unworthy.

Massasoit, ripe m. September; size, bunch 3, berry 1 to 2; form, bunch medium, shouldered; berry round; color dark brownish red; bloom, grayish

blue; flesh whitish, juicy, vinous, pleasant, pulp tender; seeds large, 1 to 2; quality 3; profitable.

Merrimac, ripe m. e. September; size, bunch 2 to 3, berry 1; form, bunch cylindrical; berry round; color black; bloom slight blue; flesh greenish white, juicy, vinous, pulp half tender; seeds large, 2 to 3; quality 3; market.

Michigan, ripe m. e. September; size, berry 1; form, bunch roundish oblong, compact; berry round; color pale green; bloom whitish; flesh juicy, vinous, rich, pulp half tender, slightly foxy; seeds 1 to 3; quality 2; a promising seedling from C. Engle, Paw Paw, Michigan.

Mills, ripe e. September, b. October; size, bunch 1, berry 2; form, bunch long, moderately compact, shouldered; berry round; color black; bloom slight, grayish; skin tough, thick; flesh juicy, vinous, rich, pulp tender; seeds 1 to 2; quality 1 to 2; a good keeper.

Naomi, ripe e. September; size, bunch 1, berry 3 to 4; form, bunch long, compact, shouldered; berry roundish oval; color pale green tinged with red; bloom whitish; flesh juicy, melting, highly vinous, pulp tender; seeds 1 to 2; quality 3.

Nectar (Black Delaware or Caywood), ripe m. e. September; size, bunch 1, berry 2 to 3; form, berry, round; color black; bloom blue; flesh whitish, tinged red, vinous, juicy, rich, pulp half tender; seeds medium, 2 to 3; quality 1 to 2; table; lacks vigor; foliage poor; not productive.

Northern Light, ripe m. e. September; size, bunch, 1 to 2, berry, 2; form, bunch rather compact, cylindrical, slightly shouldered, berry round, color greenish white; bloom white; flesh, juicy, mildly vinous, rich, very pleasant, pulp half tender, separates freely from the rather small seeds, which are usually either single or in pairs; quality 2; a very promising seedling from Ontario.

Niagara, ripe m. e. September; size, bunch 1, berry 1 to 2; form, bunch conical, compact, shouldered, berry round or slightly elongated; color greenish or yellowish white; flesh juicy, vinous, sprightly, pulp half tender; seeds rather large, 2 to 4; quality 3; market.

Osage, ripe e. September; size, bunch 1, berry 1 to 2; form, bunch compact, shouldered, berry round; color black; bloom blue; flesh whitish, juicy, sweet, foxy, pulp rather tough; seeds rather large, 1 to 3; quality 3.

Owosso, ripe e. September, b. October; size, bunch 2 to 3, berry 1; form, bunch roundish, compact, shouldered, berry round; color dark amber; bloom grayish blue; flesh whitish, juicy, highly vinous, pulp tough; seeds large, 3; quality 3; originated at Owosso, Michigan.

Ozark, ripe m. October; size, bunch 1, berry 2 to 3; form, bunch compact, shouldered, berry round; color black; bloom blue, flesh whitish, moderately juicy, pulp tough; seeds large, 1 to 4; quality 4; too late for the climate of Michigan.

Perkins, ripe b. September; size, bunch 3, berry 2 to 3; form, bunch conical, shouldered, compact, berry round; color amber or pale lilac; bloom whitish; flesh whitish, moderately juicy, poor in flavor, pulp tough; seeds 2 to 5; quality 5; too poor even for market.

Poughkeepsie, ripe m. e. September; size, bunch, 3-4, berry 3; form, bunch cylindrical, compact, shouldered, berry round; color dark wine, bloom bluish white; flesh whitish, juicy, vinous, sprightly, pulp tender; seeds small, 1 to 2; quality 1 to 2; table; plant lacks vigor.

Pocklington, ripe e. September; size, bunch 1 to 2, berry 1 to 2; form, bunch cylindrical, compact, shouldered, berry round; color yellowish white, gol-

den when fully ripe, bloom slight, whitish; flesh greenish white, juicy, foxy, pulp tender; seeds rather large, 1 to 2; quality 3; market.

Prentiss, ripe m. e. September; size, bunch 2 to 3, berry, 2-3; form, bunch cylindrical, very compact, berry round; color yellowish or greenish white; bloom slight, whitish; flesh greenish white, juicy, vinous, rich, pulp half tender; seeds 3; quality 2; skin thick; a good keeper.

President Lyon, ripe m. September; size, bunch 2, berry 2; form, bunch short, compact, berry round; color dark wine, nearly black at full maturity, bloom blue; flesh whitish, juicy, sprightly, rich, pulp half tender; seeds medium, 1 to 2; quality 1; so seriously and persistently unproductive as to render it practically worthless, notwithstanding its superior quality; it will probably not be offered for sale.

Rentz, ripe m. e. September; size, bunch 2, berry 2; form, bunch compact, shouldered, berry round; color black; nearly or quite destitute of bloom; flesh whitish, juicy, vinous, sweet, foxy, pulp tough; seeds large, 4; quality 3 to 4; berries drop from the bunch as soon as ripe; a wine grape.

Rogers 5, ripe e. September; size, bunch 2 to 3, berry 1; form, bunch round, moderately compact, berry round, color black; bloom grayish; flesh whitish, juicy, vinous, rich, pleasant, pulp half tender; seeds 3; quality 2; the genuineness of this is very doubtful.

Rogers 8, ripe e. September; size, bunch 2 to 3, berry 1; form, bunch short, roundish, berry oval, color black, bloom bluish; flesh juicy, vinous, sprightly, pulp half tender; seeds large, 1 to 6; quality 3. This also may prove spurious.

Rogers 24, ripe e. September; size, bunch 3 to 4, berry 1 to 2; form, bunch roundish, berry round; color dark purple, nearly black, bloom light, bluish; flesh greenish white, juicy, vinous, sprightly, not rich, pulp half tender; quality 3 to 4; market.

Salem, ripe m. e. September; size, bunch 3, berry 1+; form, bunch roundish, compact, shouldered, berry round; color dark chestnut; flesh juicy, vinous, sprightly, pulp half tender; seeds large, 2; quality, 2 to 3; plant very vigorous; market.

Secretary, ripe m. e. September; size, bunch 2 to 3, berry 2 to 3; form, bunch conical, moderately compact, shouldered, berry round; color black, bloom blue; flesh pale green, juicy, highly vinous, pulp firm, breaking; seeds medium, 1 to 2; quality 2; table; unprofitable on account of its tendency to mildew.

Telegraph, ripe m. September; size, bunch 3, berry 2; form, bunch medium, compact, shouldered, berry roundish oval; color black; bloom blue; flesh pale, juicy, highly vinous, spicy, pulp tough; seeds large, 4; quality 4. Nearly superseded.

Triumph, ripe m. e. October; size, bunch 1+, berry 2; form, bunch long, compact, shouldered, berry round; color pale green to golden yellow; flesh juicy, vinous, rich, pulp tender; seeds 1 to 2. Too late for this climate, unless in peculiarly favorable situation.

Vergennes, ripe m. September; size, bunch 1 to 2, berry, 1; form, bunch long, slightly shouldered, rather compact, berry round; color light amber, bloom slight, grayish white; flesh juicy, vinous, rich, pleasant, pulp tender; seeds medium, 1 to 2; quality 2; a good keeper.

Victoria, ripe e. September, b. October; size, bunch 1, berry, 1; form, bunch cylindrical, compact, shouldered, berry roundish ovate; color black,

bloom blue; flesh greenish, juicy, vinous, rather rich, pulp half tender; seeds large, 1 to 3; quality 3. There are other varieties under this name. This was received without history.

Washington (Lady), ripe b. m. October; size, bunch 1+, berry 2 to 3; form, bunch long, broad, rather compact, often double shouldered, berry round; color, yellowish white, often rosy, bloom white; flesh greenish white, juicy, vinous, sprightly, pulp tender; seeds rather large, 1 to 2; quality 2 to 3. Ripens rather late here.

Wells, ripe e. September; size, bunch 3, berry 1 to 2; form, berry oval; color, dark reddish or purplish amber, bloom grayish; flesh moderately juicy, vinous, pulp half tender; seeds large, 2; quality 3.

White Imperial, ripe m. September; size, berry 3 to 5; form, bunch cylindrical, berry round; color whitish, bloom dingy white; flesh pale, juicy, nearly sweet, pleasant, pulpy; seeds small, 1 to 2; quality, 2 to 3.

Wilder, ripe m. e. September; size, bunch 2 to 3, berry 1; form, bunch conical, shouldered, berry round; color black, bloom blue; flesh greenish or pale amber, juicy, vinous, pleasant, pulp half tender; seeds large, 2 to 3; quality 2; table; market.

Willis, ripe m. September; size, bunch 3, berry 3; form, bunch very compact, prominently shouldered, berry round; color from pale green to amber yellow, bloom very slight; flesh greenish white, juicy, vinous, almost pulpless; seeds 3 to 4; quality 3 to 4.

Winchell, ripe e. August; size, bunch 2, berry 3; form, bunch long, moderately compact, shouldered, berry round; color greenish white, bloom slight; flesh juicy, sweet, rich, pulp rather tender; quality 1 to 2. This and Green Mountain are clearly identical, and Winchell, being the earlier name, is entitled to precedence. It is so far the best very early white grape yet introduced. It holds its quality well after maturity.

Witt, ripe in September; size, berry 1; form, berry round; color greenish white, bloom slight, grayish; flesh greenish white, very juicy, vinous, pulp tender; quality 3 to 4.

Woodruff (Red), ripe m. e. September; size, bunch 1 to 2, berry 1; form, bunch roundish, shouldered, berry round; color red, with a slight bloom; flesh whitish, juicy, mild, pulpy; seeds 2; quality 3 to 4, variable. Bunches frequently small and imperfect.

Worden, ripe e. August, b. September; size, bunch 2, berry 1 to 2; form bunch long, compact, shouldered, berry round; color black, bloom blue; flesh greenish, pulpy, vinous, juicy, pleasant; seeds 2 to 3; quality 2 to 3. This should take the place of the Concord, at the north, and also in southern Michigan, when intended for home use, on account of its higher quality.

Wyoming (Red), ripe b. m. September; size, bunch 3, berry 2 to 4; form, bunch oblong, berry round; color dark wine, or red; flesh nearly colorless, juicy, sprightly, very foxy, pulpy, poor; seeds large, 2; quality 4. Unworthy.

PLUMS (*Prunus*).

As a result of repeated sprayings, or from other cause, plums generally have been almost wholly exempt from the usual premature loss of foliage; while during the unusually severe and protracted drouth of the past summer and autumn, resort was had to the constant use of the cultivator, keeping the surface well covered with a mulch of mellow soil, with the

result that trees generally have made the usual amount of growth; while those in fruit have devoloped fully its usual size and quality.

Watering has only been resorted to in the cases of a few newly planted trees, by filling a trench about them with water, and replacing the dry earth, after the water had been absorbed. Under this treatment, a few spring-planted trees only have failed, mainly those in bad condition when received.

The rose chafer (*Macrodactylus subspinosus*), which heretofore had heen mostly confined to a few plum trees on light soil, has this year become more widely disseminated, especially upon the peach, and upon a few roses near the buildings. It has been attacked by hand picking, and also in connection with the curculio by jarring upon a cloth.

The curculio, though occurring in limited numbers upon the cherry and peach, seems to have devoted its attention mainly to the plum, though, after one or two jarrings, so few were found that the work was omitted for a time, but resumed upon the reappearance of the insect.

The slug (*Eriocampa cerasi*), appeared as usual, and was sprayed with buhach in water, which (possibly from adulteration of the powder) proved but partially effective. The process was repeated, using strong tobacco water, which proved thoroughly effective.

Plums this year have suffered little, if at all, from the depredations of fungi, with the exception of the shot-hole fungus, which appeared upon several varieties in apparent defiance of the sprayings given, whether because the material employed was ineffective, or for the reason that it was not applied at the proper time, can not now be determined.

Prior to the severe freezing and snowstorm of March 25 to 30, the weather had been unusually mild for the season, so much so that the fruit buds had become developed almost to bursting. The occurrence during such storm of temperatures ranging for several days between 17° and 25°, proved fatal to the entire bloom of very many varieties, especially to those of the oriental or Japanese type, which are usually earlier in bloom, and, for that reason, the more liable to injury from late spring frosts.

But for this paroxysm of cold there would apparently have been a large number of varieties in bloom, with prospeet of a very considerable show of fruit.

On March 19 to 21, plums (in common with other tree fruits) received a spray of copper sulphate, one pound dissolved in 25 gallons of water.

May 23 sprayed plums with Bordeaux, using 4 pounds each of copper sulphate and stone lime in 32 gallons of water.

May 26 and again on the 28th jarred plum trees for curculio, finding very few. Weather cool and windy.

July 6 sprayed plums with strong tobacco water, for slugs.

August 25 sprayed plums with tobacco water for slugs.

In the following table, description of varieties of fruits is omitted, to appear subsequently in more satisfactory form than would be possible in a table.

The nomenclature of plums, as is the case throughout this report, is conformed to the rules and practice of the American Pomological society, and that of the National Division of Pomology.

PLUMS.

Alphabetical tabulation.

Number.	Name.	Species.	Planted.	Bloom.	Ripe.
1	Abundance	Hattan	1894		
2	Agen Prune	Domestica	1890		
3	Archduke	Domestica	1893	April 30.	
4	Arctic	Domestica	1891	May 1.	
5	Bailey	Domestica	1890	April 30	August 21.
6	Baker Prune	Domestica	1893		
7	Bavay	Domestica	1892	April 27.	
8	Black Diamond	Domestica	1892	April 27.	
9	Black Prune (Spurious)	Domestica	1888	April 30	August 21.
10	Botan	Hattan	1890		
*11	Bradshaw	Domestica	1890	April 27.	
12	Burbank	Hattan	1893		
13	Burbank 2	Hattan	1890	April 28.	
14	Burbank 7	Mume?	1890	April 26	August 31.
15	Burbank 11	Hattan	1890	April 27.	
16	Chabot	Hattan	1893		
17	Cheney	Americana	1888	April 29	August 16.
18	Clyman		1894		
19	Coe	Domestica	1893		
20	Columbia	Domestica	1893		
21	Cook	Hortulana?	1890	April 30.	
22	Czar	Domestica	1892	April 28	August 11.
23	De Soto	Americana	1888	May 3	Sept. 1.
24	Diamond Prune	Domestica	1894		
25	Dr. Uff	Domestica	1894		
26	Engle	Domestica	1890	Apri 28.	
27	Englebert	Domestica	1890	Apri 27.	
28	Field	Domestica	1892		
29	Forest Garden	Americana	1889	May 1	August 27.
30	Forest Rose	Hortulana var. Mineri	1890	May 1.	
31	Freestone Quetsche	Domestica	1894		
32	French Damson	Domestica	1893		
33	French Prune	Domestica	1894		
34	Garfield	Hortulana	1889	May 5.	
35	German Prune	Domestica	1892		
36	Glass	Domestica	1890		
37	G. No. 4	Domestica	1890		
38	Golden Beauty	Hortulana	1890	May 3.	
39	Golden Prune	Domestica	1894		
40	Grand Duke	Domestica	1890	April 27.	
41	Gueii	Domestica	1890	April 30	August 31.
42	Hawkeye	Americana	1888	April 30.	
43	Hungarian	Domestica	1888	April 30	August 21.
44	Jewell	Americana?	1890	May 1.	
45	Kelsey	Hattan?	1893		
46	Kingston	Domestica	1890	April 27	August 29.
47	Korai (Quetsche)	Domestica	1894		
48	Lincoln	Domestica	1890		
49	Lombard	Domestica	1890	April 28	August 29.
50	Large Green	Domestica	1894		
51	Long Fruited	Hattan	1890	Apri 7.	
52	Maquoketa	Americana	1888	May 1	Sept. 6.
53	Mariana	Cerasifera Hyb?	1890	April 30	August 6.
54	Merunka	Domestica	1888	April 30	August 14.
55	Maru	Hattan	1890	April 27	August 14.
56	McLaughlin	Domestica	1893		
57	Middleburg	Domestica	1890		
58	Miner	Hortulana var. Mineri	1890	May 3	Sept. 30.
59	Moldavka	Domestica	1888	April 28	August 14.
60	Monarch	Domestica	1893		

* Proves to be Washington.

PLUMS—CONCLUDED.

Number.	Name.	Species.	Planted.	Bloom.	Ripe.
61	Moreman	Hortulana	1890	May 3	August 14.
62	Murdy	Domestica	1892		
63	Muscat Free	Domestica	1894		
64	Naples (Beauty of)	Domestica	1889	April 30	August 30.
65	Newman	Augustifolia	1890	May 10.	
66	Niagara	Domestica	1890	April 30	August 29.
67	Nicholas (White)		1890	April 30.	
68	Ogon	Hattan	1890	April 28	July 27.
69	Orel 20	Domestica	1888	April 30	August 21.
70	Pissard	Myrobalan?	1889	April 28.	
71	Pottawattamie	Augustifolia	1894		
72	Prairie (Flower)	Hortulani var. Mineri	1890	May 1.	
73	Red June	(?)	1894		
74	Red Nagate	Hattan	1890	April 30.	
75	Robinson	Augustifolia	1890	May 3	August 6.
76	Rollingstone	Americana	1888	April 30	August 27.
77	Saratoga	Domestica	1890	April 28.	
78	Satsuma	Hattan	1890		
79	Sergent (Robe de)	Domestica	1893		
80	Shipper (Pride)	Domestica	1890	May 5.	
81	Shiro Simomo	Hattan	1890	May 3.	
82	Shropshire	Domestica	1890		
83	Silassy	Domestica	1894		
84	Simon	Simonii	1888	May 1.	
85	Spanish (King)	Domestica	1890		
86	Spaulding	Domestica	1890		
87	Stark (Gage)	Domestica	1894		
88	Tragedy	Domestica	1894		
89	Van Buren	Americana var. Mollis	1890	May 1.	
90	Victoria	Domestica	1890	April 30.	
91	Wales (Prince of)	Domestica	1892		
92	Wangenheim	Domestica	1890		
93	Weaver	Americana var. Mollis	1890	April 30.	
94	White Queen	(?)	1894		
95	Willard	Hattan	1894		
96	Wolf	Americana var.	1888	May 1	August 29.
97	Wyant	Americana	1890	May 1.	
98	Yellow Aubert	Domestica	1888	April 30	August 21.
99	Yellow Egg	Domestica	1893		
100	Yosebe	Hattan	1890	April 28	July 19.
101	Yosemite Purple	Americana	1892	May 1.	
102	Yosemite Yellow	Americana	1892	May 1.	

Descriptions are added of such varieties as have fruited during the past season, using the scale, 1 to 5, to express size and quality.

Arctic, ripe August 28; size 4; color black; bloom whitish; flesh greenish, firm, meaty, mild, pleasant, free; culinary, market.

Bailey, ripe August 23; size 1; form roundish, oval; color pale yellow; flesh orange yellow, juicy, firm, sweet, rich, nearly free from the rather large pit; quality 4; tree vigorous, upright.

Burbank 2, ripe August 20; size 2; form roundish obovate, tapering to the apex; color dark red, with numerous minute, rather indistinct specks, suture a mere line; flesh pale yellowish amber, very juicy, sweet, with a perceptible bitterness; adheres to the rather small, plump, ovate pit; imported from Japan by Luther Burbank, in 1885.

Burbank 7, ripe September 1; size 4; form roundish ovate, tapering to to the apex; color whitish, faintly marbled, suture scarcely perceptible; pit medium, oval; flesh pale amber, juicy, sweet, sprightly, rich, high flavored, free; quality 1 to 2. In both tree and fruit it possesses more or less the characteristics of domestica, although said to be a hybrid with a Japanese variety, imported from Japan in 1885, by Luther Burbank.

De Soto, ripe September 7; size 4; form round, suture slight, half around; color red; skin thick; flesh orange, tender, juicy, adheres to the pit, which is rather large, oval; quality 3 to 4; considered one of the best of its species.

Diamond (Black), ripe m. e. September; size 1; form roundish oblong, apex prominent; stem half an inch long set in a moderate cavity, suture scarcely perceptible, half around; color black, bloom dense, bluish white; flesh firm, moderately juicy, highly vinous or acid, free; quality 3; a market plum.

Forest Garden, ripe August 27; size 4; stem half an inch, slender; skin thick; color red, dotted and marbled yellowish brown, bloom slight, whitish; flesh orange yellow, fibrous, tender, juicy, adhering to the rather large nearly round pit; flavor very rich, vinous; quality 2.

Garfield, ripe e. October; size 5; form ovate; suture scarcely perceptible, half around; stem one inch, slender, set in a slight, very narrow cavity; color dark red with a few small yellow specks; flesh yellow orange, firm, juicy, acid, adheres to the pit, which is oval, pointed, plump; quality 5; probably too late to fully ripen in this climate.

Golden Beauty, ripe b. m. October; size 4 to 5; form roundish ovate, pointed at apex; stem slender, seven eighths inch, set in a very narrow, shallow, regular cavity; suture half around, scarcely perceptible; color golden, with many inconspicuous, light colored specks, apparently beneath the skin; flesh yellowish amber, tender, moderately juicy, mild, sweet, pleasant, adhering to the very small, oval pit; quality 4 to 5; exceedingly hardy, vigorous, and productive.

Gueii, ripe September 5; size 3 to 4; form round, suture very slight; stem half an inch, set in a narrow, regular cavity; color purple, bloom slight, whitish blue; flesh pale, yellowish amber, moderately juicy, firm, separating freely from the pit; quality 3 to 4; market.

Hungarian (Prune), ripe August 21; size 2; form long, oval, more rounded on one side; color black or dark purple, bloom dense, blue; flesh greenish amber, firm, moderately juicy; pit large, long, pointed, free; quality 3 to 4; promising for market or drying.

Kingston, ripe m. September; size 1; form rather long, oval, one side enlarged, apex pointed; stem stout, three fourths inch, set in a narrow, deep cavity, suture half around, one side slightly enlarged; color black, bloom dense, bluish white; flesh pale yellowish amber, not very juicy, firm, mildly vinous when fully ripe, adhering slightly to the long oval pit; quality 3 to 4; a promising, showy, market fruit.

Lombard, ripe September 5; size 2 to 3; form roundish, slightly oblong; stem one half inch, set in a narrow, regular cavity; suture imperceptible; color dark purple, bloom light, bluish white; flesh yellowish, rather firm, moderately juicy, sweet, pleasant; quality 3; nearly free. One of the most productive and popular market plums.

Maquoketa, ripe m. September; size 5; form round, suture none; color red, with many small, yellow specks; flesh yellow, firm, juicy, vinous,

slightly astringent next the skin, adheres to the pit, which is nearly round; quality 4, This as well as the entire list of native plums, is only desirable where the *domestica* varieties prove unsuccessful.

Maru, ripe August 21; size 2 to 3; form round, slightly elongated, tapering to the apex, suture scarcely perceptible; color dark brownish or purplish red; flesh pale amber or orange yellow, tender, very juicy, adhering to the pit, which is small, plump, nearly round; quality about 3.

Merunka, ripe August 14; form roundish, egg-shape; color dark purple, bloom bluish; flesh pale amber, mild, pleasant.

Miner, ripe e. September b. October; size 4 to 5; form round, remotely ovate; stem slender, three fourths inch, set in a narrow, regular cavity, suture scarcely perceptible; color dark purplish red, with many minute yellowish gray specks, bloom slight, whitish; flesh pale amber, juicy, mild, adheres to the pit, which is small, roundish, oval; unproductive at the north, apparently on account of defective fertilization of the blossoms.

Moldavka, ripe August 1 to 4; size 12; form egg-shape, stem rather long, stout; color light yellow, bloom plentiful, whitish; flesh light orange, rich, adherent at one edge only.

Naples (Beauty of), ripe September 4; size 3; form roundish, one side slightly enlarged, suture very slight; stem one half inch, set in a narrow, regular cavity; color purple, with a slight, bluish white bloom, and numerous yellow specks; flesh yellowish amber, tender, juicy, sweet, adheres partially to the pit at one edge; quality 3; a very productive market plum.

Niagara, ripe September 3; size 2 to 3; form oblong, oval, suture scarcely perceptible; color dark purple, bloom slight, bluish white; flesh pale amber, sweet, moderately juicy, parts freely from the pit; quality 3; market.

Prairie (Flower), ripe e. September, b. October; size 4 to 5; form roundish, tapering slightly toward the apex; stem slender, three fourths inch, set in a narrow, regular cavity, suture very slight; color dark purplish red, with numerous small, yellowish specks, bloom very slight; flesh light yellowish amber, moderately juicy, sweet, pleasant, adheres to the small, roundish, ovate pit; quality 5.

Robinson, ripe e. August, b. September; size 4; form round, suture a mere line, often none; color dark red, with numerous light, yellowish specks; flesh yellowish amber, tender, juicy, adhering to the small, plump, roundish pit; quality 4. A vigorous and productive tree, the most desirable of the western native plums yet fruited here.

Saratoga, ripe September 28; size 2; form oval; color dark brownish red, with a few whitish specks, bloom thin, bluish white; flesh pale amber, separating freely from the rather large, oval, pointed pit.

Orel 20, ripe August 27; size 3; form oval, or roundish cylindrical; stem slender, three eighths inch; color black; bloom bluish white; flesh pale greenish white, firm, lacking juice and flavor; pit oval, pointed, partially adherent; quality 5; of little apparent value.

Washington (trees received as Bradshaw), ripe m. October; size 1+; form roundish oval; stem one half inch, in a shallow cavity, suture very slight; color greenish yellow, slightly marbled, with spots of red next the sun, bloom slight, whitish; flesh yellow, very firm, sweet, luscious, free; quality 2; tree vigorous and productive; but fruit often decays on the tree before ripening, for which spraying is like to prove a remedy.

Wolf, ripe August 29; size 4; form round, suture scarcely perceptible; color dark red, bloom thin, pale, skin thick; flesh pale amber, acid next the skin, tender, fibrous, rich, moderately juicy; quality 4. Origin Iowa.

Yosemite Yellow, ripe September 8; size 4; form round, suture a mere line, half around, skin thick, tough, acid; color red, on yellow ground; flesh yellow, tender, sweet, rather rich, adhering to the roundish, ovate pit; quality 5.

PEARS (*Pyrus communis*).

Notwithstanding the exceeding severity of the drouth of the past summer, the pear has suffered little, if any, apparent injury therefrom, apparently for the reason that the soil has been kept constantly mellow by the frequent use of the cultivator. Watering has only been resorted to in the case of a few trees planted last spring, which had not yet a sufficient hold upon the soil.

The blight which, upon one or two Russian varieties, required rather severe cutting last year, has not reappeared the present season, and the trees are already rapidly repairing the injury. A slight attack of the malady has, however, appeared upon a couple of two-year planted trees of Vicar, in a location quite remote from the former, which have been subjected to severe cutting, with the hope to be able to eradicate it.

The slug (*Eriocampa cerasi*) is the only insect that has proved troublesome upon the pear, which, however, has been readily subdued by a strong decoction of tobacco stems.

The scab (*Fusicladium dendriticum*) has only appeared upon the foliage of three or four trees which, it may be suspected, were missed or overlooked, in previous sprayings.

Aside from the spray of copper sulphate (1 ℔. in 25 gals. water) which the entire plantation received on March 19 to 21 last, the pears were treated as follows:

On April 28, just previous to the opening of the blossoms, a spray of Bordeaux mixture, of standard strength, applied to bearing trees only.

May 8, two and three year trees (southeast block) received a spray of Bordeaux of the usual strength.

May 23, pears sprayed for scab, using 4 pounds each of stone lime and copper sulphate, with 3 ounces of Paris green in 32 gallons of water.

July 2 and 3, sprayed for slugs, using a strong decoction of tobacco stems.

August 21, treated pears for slugs, with strong decoction of tobacco stems.

The varieties of pear which have shown bloom or fruit, one or both, are included in the following table:

PEARS.
Alphabetical tabulation.

Number.	Name.	Origin.	Planted.	Blown.	Ripe.
1	Angouleme	France	1881	May 2	Oct.-Nov.
2	Ansault	France	1889	May 1	September.
3	Bloodgood	New York	1888	May 1	August 10.
4	Brandywine	Pennsylvania	1888	May 9	Aug.-Sept.
5	Clairgeau	France	1891	May 3	Oct.-Jan.
6	Clapp Favorite	Massachusetts	1888	May 4	August 27.
7	Dana Hovey	Massachusetts	1888	May 1	Nov.-Jan.
8	Gakovsk	Russia	1888	May 8	August 10.
9	Gray Doyenne	France	1888	May 1	October.
10	Howell	Connecticut	1888	May 5	Sept.-Oct.
11	Kurskaya	Russia	1888	May 7.	
12	Lawrence	New York	1888	May 1	December.
13	Louise (Jersey)	England	1891	May 5	October.
14	Lucrative	Flanders	1888	May 1	e Sept.
15	Margaret	Ohio	1889	May 1	August 8.
16	Mount Vernon	Massachusetts	1888	May 4	Nov.-Dec.
17	Ogereau	France	1891	May 2.	
18	Pound	Europe ?	1889	May 4	Winter.
19	Rostiezer	France	1888	May 4	Aug. 21.
20	Seckel	Pennsylvania	1888	May 1	Sept.-Oct.
21	Tyson	Pennsylvania	1888	May 7	e Aug-b Sept
22	Victorina	Russia	1888	May 1	Aug. 23.
23	Winter Nelis	Europe	1888	May 1	Dec.-Jan.

Notices are appended of such as have fruited sufficiently to warrant conclusions respecting season and quality.

Size and quality are given in numerals upon the scale 1 to 5; b. beginning, m. middle, e. end of the month.

Angouleme, ripe October to November; size 1+; form oblong obovate, knobby; dull greenish yellow, with much russet; stalk stout, one inch, set in a deep, irregular cavity; calyx in a knobby basin; flesh white, juicy, buttery, rich; quality 3. Generally grown as a dwarf.

Ansault, ripe m. e. September; size 2 to 3; form conical; stem three fourths inch, stout, set in a slight, narrow cavity; basin broad, very shallow; calyx open, segments erect, calyx tube nearly conical, slightly funnel-shape; color yellow, much russeted; flesh whitish, moderately juicy, vinous, pleasant; core compact; seeds few, often abortive; quality 3; new, and imperfectly tested; gives indications of early and profuse productiveness.

Bloodgood, ripe August 10; size 3; form turbinate or obovate; color yellow with russet dots and markings; flesh yellowish white, buttery, melting, rich, sweet, aromatic; quality 3. One of the best dessert varieties of its season.

Brandywine, ripe e. August, b. September; size 3; form varying from oblate to oblong pyriform; stem fleshy, inserted with folds or rings, calyx open, basin regular, shallow; color yellowish green, brighter toward the sun; flesh white, juicy, melting, sugary, and vinous; quality 4.

Clairgeau, ripe October to December; size 1 to 2; form pyriform, with sides unequal; stalk stout, fleshy, inclined, inserted with a lip, basin shallow, furrowed, calyx open, segments stiff, nearly erect; color warm yellow and red, with more or less russet; flesh yellowish, buttery, juicy, granular, vinous, not rich; quality 4 to 5; market.

Clapp Favorite, ripe August 27; size 1; form obovate, or ovate pyriform; stem one inch, inclined, stout, set in a slight cavity, basin shallow, slightly

ribbed, calyx partially closed, segments erect; color pale yellow, marbled and splashed with crimson, with russet patches; rots at the core if left to ripen upon the tree; flesh white, fine grained, juicy, buttery, melting, rich, vinous, perfumed; quality 3; dessert, market.

Dana Hovey, ripe November, January; size 4 to 5; form obovate, obtuse pyriform, regular; stem half an inch, set in a slight, narrow cavity, basin rather narrow, shallow, regular, calyx open, segments upright; color greenish yellow, sometimes slightly russeted; flesh yellowish, juicy, melting, sugary, rich, aromatic; quality 1; dessert.

Gray Doyenne, ripe m. e. October; size 3; form ovate, obovate; stem three fourths inch, set in a narrow, abrupt cavity; calyx small, closed; basin smooth, shallow; color smooth cinnamon russet, sometimes reddened in the sun; flesh white, fine grained, buttery, melting, rich, delicious; quality 1; an old and valued dessert pear.

Howell, ripe e. September, b. October; size 2 to 3; form roundish obovate; stem an inch long, stout, set in a narrow, shallow cavity; calyx small, open; calyx tube cup-like; color rich yellow; with a suspicion of red in the sun, and numerous, conspicuous, grayish dots; flesh white, very juicy, vinous, sprightly, pleasant; seeds few, core compact; quality 2; dessert, market.

Lawrence, ripe December; size 3; form obovate, obtuse pyriform, regular; stem medium, rather stout, in an irregular russeted cavity; calyx open, segments short, persistent; basin broad, shallow, slightly ribbed, russeted; color lemon yellow, with patches of russet, and many minute brown dots; flesh whitish, juicy, melting, sweet, aromatic; quality 2 to 3; an excellent early winter pear.

Louise (Jersey), ripe e. September, October; size 2; form oblong pyriform, slightly one-sided; stem one inch, set obliquely, with an enlarged, fleshy base; calyx open, in a shallow, uneven basin; color pale green, glossy, with a brownish red cheek, and dotted with numerous gray dots; flesh greenish white, very juicy, melting, with excellent, rich flavor; quality 3 to 4; much grown as a dwarf.

Lucrative, ripe e. September; size 3; form obovate obtuse pyriform, sometimes nearly globular; stem one inch, stout, inserted obliquely in a slight cavity; calyx open, with few divisions, basin rather shallow; color pale yellowish green, slightly russeted; flesh juicy, melting, rich; quality 1 to 2; an old, delicious dessert fruit.

Margaret, ripe August; size 2 to 3; form oblong, obovate; stem medium, cavity none; calyx large, open, segments long, reflexed; color yellow, mostly covered with deep red, with small russet dots; flesh white, juicy, vinous, sweet; quality 4.

Mount Vernon, ripe November, December; size 2 to 3; form roundish, obtuse, pyriform; stem short, stout, inclined, with a lip; calyx small, closed, segments upright, short; color yellowish, netted and mostly covered with light, cinnamon russet; flesh yellowish, granular, juicy, melting, slightly vinous, aroma slight; quality 3.

Pound, ripe through winter; size 1+; form pyriform; stem stout, two or more inches long, curved; calyx large, segments irregular, upright; calyx tube funnel-like; basin broad, shallow, slightly corrugated; color yellowish green, with a reddish brown cheek, and many large russet spots and patches; flesh very firm, austere, astringent before maturity, yellowish white, vinous, stews red; good baked or preserved; culinary only.

Rostiezer, ripe August 21; size 3 to 4; form obovate, oblong pyriform;

stem long, slender, curved, cavity very slight, calyx open, basin small, corrugated; color yellowish green, with reddish brown in the sun; flesh yellowish white, juicy, melting, slightly buttery, very sweet, vinous, aromatic; quality 1. Not attractive, but excellent; shoots spreading, stout, vigorous.

Seckel, ripe September, October; size 4 to 5; form obovate, regular; stem half an inch or more in length, cavity slight, calyx small, basin very shallow; color, when fully mature, yellowish brown, with a russety red cheek; flesh whitish, buttery, melting, very juicy, with a very rich, spicy flavor and aroma; quality 1+; the standard of quality among pears.

Tyson, ripe e. August, b. September; size 3 to 4; form acute pyriform; stem long, curved, inserted with a ring or lip, calyx open, in a shallow basin; color clear yellow, when mature, with slight russet, a crimson cheek, with many small, brown dots; flesh rather fine grained, juicy, melting, sweet, slightly aromatic; quality 1 to 2; a somewhat tardy bearer.

Victorina, ripe b. m. September; size 3 to 4; form depressed turbinate; stem one and a fourth inches long, set in a slight cavity; calyx large, segments erect; color yellow, dots very numerous, generally large, dark gray; flesh pale yellow, coarse, granular, tender, juicy, sweet; quality 4; decays soon at the core. Tree upright, vigorous.

Winter Nelis, ripe October, January; size 3; form roundish obovate; stem one and one fourth inches, set in a narrow, shallow cavity, calyx open, segments long, upright or reflexed, basin shallow, broad, regular, russeted; color greenish yellow at maturity, often nearly covered with a network of russet; flesh yellowish white, fine grained, buttery, very melting, juicy, rich, sweet, perfumed; quality 1. Tree productive, vigorous, but very straggling.

APPLES (*Pyrus malus*).

The trees upon the place are yet too young to give more than a slight indication of productive qualities, though several varieties have matured a few specimens each, while in nearly all cases the growth has been satisfactory, under constant cultivation, notwithstanding the unprecedented drouth.

The green aphis (*Aphis mali*) and the larvæ of the codlin moth have been the only injurious insects troublesome the past season, while the trees and fruit have been unusually exempt from the attacks of fungi.

The Austrian or Hungarian varieties, received in 1893, through the National Division of Pomology, in scion, and grafted in nursery, have now been transferred to the orchard rows. Of these there remain eleven varieties of apple, a few having failed, apparently from the unfavorable condition of the scions when received.

Scions of forty varieties of new, reputed hardy, western apple, were received from B. Hathaway of Little Prairie Ronde, Michigan, several of which were grafted upon orchard stocks, and the remainder in nursery.

The apple plantations were included in the spraying of March 19 to 21 last, with one pound of copper sulphate in twenty-five gallons of water.

On May 17, apples were again sprayed with Bordeaux mixture of the usual strength.

May 23, applied a spray consisting of four pounds each of copper sulphate and stone lime in thirty-two gallons of water, for scab, adding three ounces of Paris green for the codlin moth.

July 10, apples were sprayed with tobacco water to subdue the aphis.

July 18 to 20, repeated the spray of tobacco water upon part of the apples, to complete the destruction of the aphis.

Tabulation of apples blooming and a portion of them having fruited.

Number.	Name.	Origin.	Planted.	Bloom.	Ripe.
1	August	Minnesota	1890	May 8.	
2	Babbitt	America	1890	May 8.	
3	Barty	America	1888	May 12.	
4	Batullen	Russia	1888	May 10.	
5	Borovinka	Russia	1888	May 7	b-Sept.
6	Bottle Greening	Vermont	1890	May 10.	
7	Bough	America	1888	May 17.	
8	Bradford	Kentucky	1890	May 10.	
9	Cogswell	Connecticut	1888	May 12.	
10	Colton	America	1888	May 11.	
11	Cornell	Pennsylvania	1890	May 9.	
12	Craine	Illinois	1888	May 10.	
13	Dartmouth	America	1890	May 11.	
14	Decarie	Canada	1890	May 10.	
15	Dyer	America	1888	May 7.	
16	Excelsior	New York	1890	May 8.	
17	Florence	Minnesota	1870	May 4	Aug. 23.
18	Gideon	Minnesota	1890	May 9.	
19	Gloege	Wisconsin	1888	May 8.	
20	Golden Reinette	Europe	1888	May 5.	
21	Golden Russet (N. Y.)	England	1888	May 8	Dec.-May.
22	Grimes	Virginia	1890	May 12.	
23	Hawley	America	1888	May 12.	
24	Hubbardston	Massachusetts	1888	May 12.	
25	Jefferis	Pennsylvania	1888	May 8.	
26	Jelly	Minnesota	1890	May 8.	
27	Jersey Sweet	New Jersey ?	1888	May 7	b-Sept.
28	Jonathan	New York	1888	May 8	Oct.-Mar.
29	Keswick	England	1888	May 7	b e-Sept.
30	Lou	Minnesota	1890	May 4	Aug. 18.
31	Louise	Ontario	1890	May 11.	
32	Lowell	America	1888	May 7	m-Sept.
33	Magog	America	1890	May 9.	
34	Martha	Minnesota	1890	May 8.	
35	Mason Orange	America	1890	May 12.	
36	McIntosh	America	1890	May 12.	
37	Melon	New York	1888	May 8.	
38	No. 2, New	Minnesota	1890	May 7	Sept.
39	Oakland	Michigan?	1888	May 7	Nov.-Mar.
40	Ontario	Ontario	1890	May 10	Winter.
41	Peter	Minnesota	1890	May 7	Sept.
42	Pickett, Late	America	1888	May 11.	
43	Primate	America	1888	May 8.	
44	Rambo	America	1888	May 12.	
45	Red Aport	Russia	1888	May 8	m-Sept.
46	Red Astrachan	Russia	1888	May 7.	
47	Red Dettmer	Russia	1888	May 4	b-Sept.
48	Rhode Island	America	1888	May 11.	
49	Ribston	England	1888		
50	Ronk	Indiana	1888	May 8.	
51	Rosenhager	Russia	1888	May 7	m-Sept.
52	Roxbury	Massachusetts	1888	May 7	Dec.-June.
53	Sheriff	Wisconsin ?	1891	May 12.	
54	Stark	Ohio	1888	May 8.	
55	Summer Pearmain	America	1888	May 8.	
56	Summer Rose	America	1892	May 12.	
57	Thaler	Europe	1888	May 9.	
58	Titovka	Russia	1888	May 7	Sept.-Oct.
59	Tolman	Massachusets	1888	May 11.	
60	Townsend	America	1890	May 9.	
61	Wealthy	Minnesota	1890	May 9.	
62	Whitney	Illinois	1890	May 12.	
63	Winter Streifling	Russia	1888	May 5.	
64	Yellow Transparent	Russia	1888	May 8	Aug. 6.
65	Zolotoreff	Russia	1890	May 8.	

In describing apples the following scale is employed for expressing size, as a combination, including both apples and crabs.

1+	varieties above 4 inches in diameter.	
1—	4 inches in diameter	Apples (*Pyrus malus*).
2	$3\frac{1}{4}$ " " "	
3	$3\frac{1}{2}$ " " "	
4	$3\frac{1}{4}$ " " "	
5	3 " " "	
6	$2\frac{3}{4}$ inches in diameter	Crabs (*Pyrus baccata*).
7	$2\frac{1}{4}$ " " "	
8	$1\frac{3}{4}$ " " "	
9	$1\frac{1}{4}$ " " "	
10	$\frac{3}{4}$ " " "	
10—	varieties below $\frac{3}{4}$ inches in diameter.	

Florence (crab), ripe August 23; size 8 to 9 (diameter one and one half inches); form oblate; cavity deep, narrow; stem slender, one and one half inches long; basin broad, shallow, plaited; calyx large, closed, tips reflexed; color yellow, with a red cheek; flesh pale yellow, very firm, high flavored, acid; core compact, large for size of fruit; seeds large, plump; quality 5; originated by P. M. Gideon of Minnesota.

Gideon (crab), ripe October, November?; size 5 to 6; form roundish, slightly conical; cavity, broad, deep, nearly regular; stem one and one half inches, slender; basin narrow, rather deep, slightly corrugated; calyx small, closed, calyx tube the frustrum of a cone; color greenish yellow, with a faint brownish cheek; flesh white, juicy, acid; core medium, slightly open; quality 3 to 4; originated by P. M. Gideon of Minnesota.

Jersey Sweet, ripe b. September; size 3 to 4; form roundish conical, cavity deep, narrow, irregular; stem one half inch, basin narrow, abrupt, irregular, calyx closed, calyx tube very long, funnel-shape; color two shades of red, striped on a yellow ground; flesh yellowish white, coarse, crisp, not very juicy, sweet, rich; core slightly open; seeds ovate, pointed; quality 2; probably the most desirable sweet apple of its season.

Jonathan, ripe October, March; size 3 to 4; form round, remotely conical, regular; cavity deep, rather narrow, generally a little russeted; stem three fourths inch, slender; basin narrow, deep, slightly ribbed; calyx closed, calyx tube funnel-shape; color dark, glossy red, on yellow ground, specked and netted with grayish russet; flesh white, crisp, juicy, subacid, rich; quality 2; valuable for table and market.

Keswick, ripe during September; size 3 to 4; form roundish ovate, strongly ribbed, cavity irregularly five-angled, broad, shallow; stem one half inch, stout, sometimes fleshy; basin narrow, shallow, much corrugated; calyx closed, calyx tube conical; core medium, closed; seeds few, often imperfect; color yellow, often with an orange blush; flesh firm, moderately juicy, acid; an excellent culinary fruit, even before maturity; an enormous bearer.

Lou (crab), ripe August 18; size 3 to 4; form roundish ovate, narrow, deep; stem three fourths inch, medium; calyx closed; color greenish yellow, faintly striped; flesh coarse, tender, acid; quality 3; culinary; originated by P. M. Gideon of Minnesota.

Lowell, ripe September; size 1 to 2; form approaching cylindrical, often irregular; cavity rather deep, nearly regular, russeted; stem one inch,

stout; basin rather wide, shallow, plaited; calyx closed; color pale yellow, with a greasy feel, hence its synonym—Greasy Pippin; flesh whitish, coarse, granular, a pleasant acid, juice plentiful; seeds few; quality 3; a productive dessert and market fruit.

No. 2, New (crab), ripe September; size 3; form roundish oblate, slightly conical; cavity broad, rather deep, regular, with a little brownish russet; stem one and one half inches, slender, baisin broad, shallow, calyx partially open; segments reflexed; calyx tube bowl-like; flesh greenish white, acid, juicy, tender; core open, large seeds, many, small, plump, nearly round; quality 4; culinary; one of P. M. Gideon's seedlings, Minnesota.

Oakland (Oakland Co. Seeknofurther), ripe November, March; size 3 to 4; form oblate, irregular; cavity narrow, deep, irregular, russeted; stem one one fourth inches, slender; basin irregular, slightly corrugated, broad, shallow; calyx small, closed; calyx tube conical; flesh white, crisp, fine-grained, mild subacid, juicy, very pleasant; core nearly closed, small; seeds small, ovate; quality 2; table, market.

Oldenburg (Borovinka of J. L. Budd), ripe b. September; size 2 to 3; form roundish oblate, regular; cavity acute; stem medium; basin wide, regular; calyx large, closed; color yellow, distinctly striped, with a light bloom; flesh white, tender, juicy, rather acid; quality 3 to 4; valuable for cooking and market; tree vigorous, very productive, and hardy; Russian.

Ontario, ripe January to April; size 2; form oblate, remotely conical, slightly irregular; cavity broad, deep, sometimes lipped, russeted; stem one half inch, slender; basin rather narrow, deep, corrugated, irregular; calyx small, closed; color bright yellow, with a clear, red cheek in the sun; dots few, whitish; flesh whitish yellow, tender, juicy, subacid, aromatic, core closed, small; seeds few, ovate; the offspring of a cross between Northern Spy and Wagener by the late Charles Arnold of Ontario.

Peter, ripe m. e. September; size 2; form oblate, regular; cavity, broad, deep, with gray russet; stem one half inch; basin narrow, deep, slightly plaited; calyx rather large, irregularly closed; calyx tube conical; color yellow, washed with red over nearly the entire surface, and striped with darker red, with conspicuous yellowish gray dots; flesh white, crisp, tender, juicy, brisk subacid, a little coarse; core small, closed; seeds few, ovate, conical; quality 3; a kitchen and market fruit if productive; another of P. M. Gideon's, Minnesota.

Red Aport, ripe m. September; size 1 to 2; form obtuse conical, irregular; cavity narrow, densely russeted; stem three fourths inch, stout; basin narrow, deep, irregular; calyx closed; calyx tube conical; color yellow, mostly overspread and obscurely striped with red; flesh white, firm, crisp, fine-grained, moderately juicy, mild subacid; core small, closed; seeds few, ovate, pointed; Russian.

Red Dettmer, ripe b. September; size 2; form roundish, oblate, conical; cavity broad, deep, russeted; stem one half inch; basin shallow; calyx with long, half reflexed segments; calyx tube short, slightly funnel-shape; color two shades of red, obscurely striped on a yellow ground; flesh white, crisp, coarse, sharp subacid, tender, moderately juicy; core rather large, closed, seeds few, large, pointed; Russian.

Rosenhager, ripe m. e. September; size 1 to 2; form round, regular, slightly oblate conical, cavity narrow, deep, with faint whitish-gray russet; stem three fourths inch, rather slender, basin broad, shallow, corrugated, calyx large, nearly closed; color greenish (or yellow when mature), overspread

or faintly striped with dark brownish red and with numerous light gray dots; flesh greenish white, juicy, acid, crisp, tender, core open, seeds long, pointed; quality 4 to 5; European.

Roxbury, ripe December to June; size 2 to 3; form oblate conical, slightly irregular; cavity broad, deep; stem three fourths inch, stout; basin broad, moderately deep, slightly plaited; calyx large, partially closed, calyx tube conical; color grayish russet, with a few lighter raised dots; flesh white, coarse, firm, crisp, sharp subacid; quality 2 to 3; culinary and late marketing; a vigorous, very spreading tree.

Titovka, ripe September, October; size 1; form roundish, flattened at ends, somewhat angular; cavity deep, irregular russeted; stem one half to three fourths inch, stout; basin rather deep, irregular, slightly plaited, abrupt; calyx closed, but not covering the tube, which is funnel-shape; color yellow, mottled, faintly striped and nearly covered with two shades of red, thickly sprinkled with conspicuous yellowish dots; flesh yellowish white, tender, crisp, breaking, rather coarse; core small compact, seeds large ovate, one to two in each carpel; quality 3; culinary, and also market, if productive; Russian.

QUINCES (*Cydonia*).

During the past two years the quinces at this station have been exempt from the depredations of fungi and of insects, as well, with the single exception of the slug (*Eriocampa cerasi*), which yielded readily to a spray of tobacco water applied July 3, and again for a second colony on July 25.

Quinces have bloomed and fruited during the past year, as follows:

Number.	Name.	Origin.	Planted.	Bloom.	Ripe.
1	Alaska	N. Y.?	1892	May 16.	
2	Champion	Am.	1888	" 16	e Oct.
3	Meech	N. J.	1889	" 16	e Oct.
4	Missouri	Mo.?	1890	" 17.	
5	Orange	Eur.	1888	" 17	b m Oct.
6	Rea	Am.	1889	" 16	b m Oct.

Champion ripens so late as to be uncertain in our occasionally unfavorable seasons. The plant is vigorous and very prolific.

Meech is scarcely the equal of Orange in either beauty or size, though it is claimed to excel it in productiveness—a claim yet to be established here.

Orange yet holds an assured position as the leading market variety.

Rea is, so far, slightly larger than Orange, and even more beautifully colored, but is scarcely its equal in productiveness.

So far as quality is concerned there is but slight occasion for choice between varieties.

NUTS.

ALMONDS (*Amygdalus communis*).

Luelling, a hard-shelled variety, received from Missouri, and planted in 1892, showed bloom last spring, but failed to develop fruit. It is hardy here.

A soft-shelled almond tree planted in 1893 has also passed the winter here without apparent injury, although it is understood that soft-shelled

varieties, as a class, lack hardiness for this latitude. This may be expected to fruit next season. Till this shall occur, its genuineness may be considered uncertain.

CHESTNUTS (*Castanea vesca*).

The seedlings from B. Hathaway's large native chestnut, which was planted in 1889, although they developed catkins in 1893, have not, so far, produced fruit.

Japan Giant has shown fruit this season, which proves to be nearly or quite as large as Paragon, though, so far, not equal to it in quality.

Paragon has again produced a fine crop of very large nuts. In fact, the crop set was so excessive that, either from that cause, the excessive heat and drouth of the summer, or from the concurrence of the two, a considerable portion of the crop dropped prematurely. The matured crop was, however, a large one, considering the size and age of the trees.

Numbo, although but one year planted, and making only moderate growth, has nevertheless produced a few catkins, affording an indication of decided precocity.

A seedling Japan chestnut has now fruited. The burs are very small and the nuts, so far, of no value.

A seedling Spanish chestnut has also matured a crop of large nuts, but is by no means the equal of the Paragon in quality.

CHINQUAPIN (*Castanea pumila*).

Efforts, whether with seeds or plants, have, so far, failed with this, which transplants with difficulty, while the seeds received have been generally ruined by the larvæ which so frequently infest the common chestnut. A few nuts, apparently in excellent condition, have been recently received through the Division of Pomology, at Washington, and have been carefully planted, with the hope of a more favorable result.

ENGLISH WALNUT OR MADIERA NUT (*Juglans regia*).

This, though planted in 1889, has, so far, escaped injury from winter cold, though it has not made the vigorous growth with which it is generally credited. Its ultimate success in this climate may be reasonably considered doubtful.

Præparturiens, a dwarf variety of the above, appears to be equally hardy but has not yet fruited.

FILBERTS AND HAZELNUTS (*Corylus*).

Kentish Cob filbert, planted in 1892, has not yet fruited. It has, so far, withstood our winters without injury, and has proved healthy and vigorous.

Hazelnut plants, understood to be of American parentage, received from the Division of Pomology and planted in 1893, are in vigorous condition, showing their adaptation to this climate. They have not yet shown fruit.

Plants were also received from the Division of Pomology, of a hazelnut discovered in the state of Washington, where it grows to the size of a tree eight inches in diameter; but although a single plant is yet living it has made very little growth and is obviously not suited to this locality.

JAPAN WALNUT (*Juglans Seiboldii*).

This was planted in 1890, and has now produced its second crop of nuts, which are smaller and less roughened, outwardly, than the butternut, though similar in quality and general appearance. The tree also somewhat resembles the butternut, in both foliage and habit of growth, though decidedly more vigorous. It is entirely hardy here.

PECAN (*Hickoria olivæformis*).

Nuts from Iowa were planted here in the autumn of 1888, and, so far, have withstood the cold of our winters perfectly. The young plants grew slowly for the first year or two, which we understood to be its usual habit. More recently they have shown abundant vigor.

Seeds of Stuart Pecan, a large, thin shelled seedling originating in Texas, were received through the Division of Pomology and planted in 1893. The plants have been "earthed up" for protection during the past two winters, since, coming from so far south, their hardiness must be considered uncertain, at least for the first few years.

FIGS (*Ficus carica*).

Plants of Brunswick fig were set out in the spring of 1893, to test the practicability of growing this fruit in open air in this climate. The plants have been trained as bushes, carefully laid down and covered during winter, and have made moderate growths each year, setting more or less fruit, which has, each season, been overtaken by freezing weather before maturity. From this experience it seems probable that success is only practicable with the use of a much earlier variety.

ASPARAGUS (*Asparagus officinalis*).

Of the six or seven varieties of asparagus on trial here Palmetto has shown a constant superiority in both size and productiveness, with Conover a close second.

A more recent variety, offered by D. M. Ferry & Company, has been this year added to the list, but needs another year or two become fully established.

RHUBARB (*Rheum rhaponticum*).

Two or three varieties, claiming to be specially early, were planted to test their merits in this particular, but have not, so far, justified such claim.

Linnæus proves to be equally early, and of quite as good quality, with greatly increased size as well as superior productiveness. It has long stood at the head of the list, and is yet without a superior.

Plants of a variety received from S. S. Bailey of Kent county, Michigan, understood to be a seedling of his, prove to be of fine quality, large size, and of unusually dark green color. It seems worthy of extensive trial.

SOUTH HAVEN, MICHIGAN,
December 31, 1894.

SMALL FRUIT NOTES.

BY L. R. TAFT AND H. P. GLADDEN.

Bulletin No. 122.

The number of new varieties of fruits placed on the market each year is so large that individuals can not afford to test them upon their own grounds, so we have endeavored to keep our collection so complete that it would enable us to give information as to the relative merits of the different varieties to prospective planters. Not only do we have a duplicate collection upon the sub-station grounds at South Haven, but there are a large number of fruitgrowers in various parts of the state who are aiding us by reporting the results obtained upon their grounds.

In many cases the varieties noted in this bulletin were sent here for trial by the originators and we are thus able to give information to would-be purchasers, as soon as they are placed upon the market.

STRAWBERRIES.

The soil upon which the strawberries have been grown is a sandy loam containing a considerable mixture of clay. The land was well enriched with stable manure the fall before the plants were set. (The plants were set in the spring of 1893 and most of the data were obtained from this setting, though another plat, containing most of the varieties noted, set the season of 1892, was kept for comparison.) A heavy mulch of straw and marsh hay was given the plants in the fall. The spring following, the mulch was moved to adjoining rows to permit of a shallow and thorough cultivation, then replaced as a mulch and to keep the berries from the ground. Early in the spring the plants were sprayed with Bordeaux mixture. Four applications were made, the last about two weeks previous to the ripening of the crop. The benefit of the sprayings was clearly shown in the almost entire absence of leaf blight on the plants treated; while plats purposely left unsprayed, for comparison, were badly affected with the disease.

The frequent and abundant rains occurring in the early part of the season gave the plants a vigorous growth. Nearly every variety blossomed full and set a large amount of fruit, but the protracted drouth soon coming on greatly lessened the yield.

TABLE No. 1.—STRAWBERRIES.

ABBREVIATIONS.

Form.		Size.	Color.	
b, broad.	l, long.	s, small.	b, bright.	l, light.
c, conical.	o, oval.	m, medium.	c, crimson.	r, red.
d, depressed.	r, round.	l, large.	d, dark.	s, scarlet.
i, irregular.				

Variety.	Sex.	Vigor (1-10).	Date of bloom.	First ripe fruits.	Last fruits.	Productiveness (1-10).	Size.	Form.	Color.	Quality.	Firmness.
Accomac	b	8	May 8	June 12	June 27	6	m	l c	d c	9	7
Afton	p	7.9	" 8	" 11	" 28	9.6	m to l	r c	d c	9	8.8
Alabama	b	8.4	" 8	" 14	" 27	5	m	r c	d c	9	9.5
Alpha	b	8.5	" 8	" 13	" 27	8.5	m	c	l c	8	6
America	b	8.7	" 8	" 12	" 27	9	m	r c	b d s	9.5	9
Banquet	p	7.5	" 7	" 11	" 27	8.8	m	c	d c	9	7
Beauty	b	8.5	" 5	" 11	" 28	9	l	r b c	b d s	8.5	8
Beder Wood	b	9	" 5	" 11	" 27	9	s to m	r	l c	7	8
Belle	b	8	" 8	" 17	" 27	9	m to l	l c	b s	8	9
Belle of Lacrosse	p	8.1	" 8	" 12	" 28	9.8	l	r b c	b d s	8	8
Beverly	b	8.5	" 8	" 11	" 27	8.8	l	r c	d c	9.5	9.5
Bickle	p	8	" 8	" 12	" 27	9.5	s to m	r c	l s	7	7
Bird	p	9.2	" 5	" 12	" 28	9.5	l	l c	b d s	9	9.2
Bomba	b	7	" 6	" 11	" 28	8.5	m	c	d c	9	8.5
Bowman	b	7	" 11	" 12	" 26	6	l	r c	l s	9	7
Boynton	p	8	" 7	" 11	" 28	9.2	s to m	o	l c	8	8.5
Brandywine	b	9.9	" 12	" 14	" 29	9.4	l	r c	b d c	9.5	8.5
Brunette	b	9	" 11	" 12	" 26	9	l	r c	b s	9.8	9
Bubach	p	9	" 8	" 11	" 28	8.5	l	d c	l c	9	8
California	b	6	" 8	" 12	" 28	6	s to m	l c	b d s	9.5	9
Cameronian	b	9.8	" 5	" 12	" 28	7.5	m	r c	l s	7	7
Chairs	p	9.4	" 11	" 12	" 28	9.4	l	b c	b c	7	7.5
Charlie	p	9.3	" 13	" 14	" 28	7	m	l c	b d s	9	8.8
Cheyenne	p	8.8	" 11	" 18	" 28	8.8	m to l	l c	b s	9	8.5
Childs	b	8.3	" 8	" 12	" 28	9.6	l	d c	b c	9.5	9
Clark Early	b	6.6	" 7	" 6	" 28	8	l	r o i	d c	9	9
Clark Seedling	b	7.8	" 11	" 6	" 27	8	l	r c	d c	9.2	8
Clyde	b	8.9	" 6	" 13	" 27	9.5	l	r c	l s	9	8.5
Crawford	b	9	" 10	" 13	" 28	9	m	r c	s	9	9
Crescent	p	9	" 7	" 7	" 26	9.2	m	r c	l s	7	8
Dan Bisel	b	10	" 8	" 11	" 28	9.7	m	l b c	b c	9	9
Dew	b	7	" 10	" 14	" 30	7	l	i	d c	8	9
Dutter	b	8	" 8	" 13	" 29	8	l	l c	b s	9	8.5
Eclipse	p	8	" 8	" 12	" 27	6	s to m	o	l c	8.5	7.5
Edgar Queen	b	8	" 8	" 13	" 27	9	m to l	i r c	l c	7	8
Edward's Favorite	b	6.5	" 13	" 14	" 28	9.4	l	r c	b d c	9.4	9
Enhance	b	8.9	" 8	" 12	" 28	9.5	l	i r	d c	9	9
Epping	p	9	" 8	" 11	" 27	9.5	l	r d c	l s	8	9
E. P. Roe	b	7	" 7	" 17	" 27	2	l	b c	s	8.5	8
Eureka	p	8	" 10	" 13	" 29	8	m	r c	d c	7	8
Fairmount	b	8.5	" 11	" 12	" 28	9	l	d c	d c	9	7.5
Gandy	b	9.5	" 16	" 16	" 28	8.5	l	r b c	l s	9	8
General Putnam	p	8.5	" 7	" 17	" 26	8.5	m	r	l s	8	8
Glenfield	b	8.6	" 7	" 11	" 27	8	m	l c	d c	9	7
Great Pacific	p	8	" 11	" 14	" 27	8	m s	d c	r	9	8
Greenville	p	8.6	" 8	" 11	" 27	9.6	l	r d c	b c	8	7
Gypsy	p	7.6	" 11	" 11	" 28	9	m	r c	d c	9	9
Harmon	b	8.4	" 7	" 10	" 28	4	l	r c	v d c	8.5	8
Hattie Jones	p	8.4	" 12	" 13	" 29	9.5	m to l	r d c	l s c	6	7
Haverland	p	9.4	" 6	" 11	" 27	9.5	m	l c	s	8	8
Hermit	b	8.5	" 6	" 11	" 28	9.2	l	r c	d c	8	8
Hoard	b	8.5	" 8	" 12	" 26	9	m to l	r c	l c	8	8
Huntsman	p b	8.9	" 12	" 12	" 28	9.2	l	r c	d c	9	8
Hyslop	b	9.3	" 6	" 4	" 24	4	s	i	d	8.5	8.7
Iowa Beauty	b	8	" 8	" 11	" 28	8.8	l	r c	d c	9.8	8.5

TABLE NO. 1.—STRAWBERRIES.—CONTINUED.

Variety.	Sex.	Vigor (1-10).	Date of bloom.	First ripe fruits.	Last fruits.	Productiveness (1-10).	Size.	Form.	Color.	Quality.	Firmness.
Jay Gould	p	9.2	May 10	June 13	June 28	9.2	m	r c	b c	9.2	9
Jessie	b	9	" 9	" 13	" 30	8	m to l	r c	d c	7	9
Jones Seedling	b	8.3	" 7	" 11	" 28	9	l	d c	d c	9	8.5
Judsonia	b	8.8	" 16	" 13	" 26	8.8	l	r b c	l c	7.5	7
Katie	b	9.1	" 10	" 12	" 28	8.8	l	r d c	c	8.5	7.5
King No. 2	b	9	" 6	" 11	" 27	7	m	r c	l c	8	8
Klickita	p	8.4	" 9	" 16	" 28	9.5	l	r d c	d s	9	7.5
Leader	b	7.3	" 5	" 11	" 26	8.2	m to l	l c	v d c	9	9
Leroy	p	9.8	" 8	" 12	" 28	9.8	l	d c	d c	9	9
Leviathan	b	7.3	" 10	" 14	" 29	8	l	b d	l s	8.5	9
Lida	p	8.9	" 8	" 11	" 28	8.8	m	r c	b c	8.5	8
Lillie Monroe	b	8.4	" 8	" 12	" 26	4	l	d c	d s	8	7
Lincoln	p	8.6	" 10	" 11	" 26	9.7	m	r d c	b s	8	9
Long John	b	8.6	" 8	" 11	" 27	9.4	m to l	v l c	b c	9	8.5
Lovett	b	7.3	" 6	" 11	" 27	8	m	r c	b c	8	9
Lower	b	8.8	" 8	" 12	" 27	7.5	l	r c	d s	8	8
Luther	b	8.3	" 8	" 11	" 26	6	s to m	l c	b s	9.5	8.5
Magnate	p	8.6	" 8	" 13	" 30	9	m to l	l c	b s	9	9
Michel	b	7	" 8	" 9	" 26	6	s	c	b s	7	7
Middlefield	b	8.5	" 6	" 12	" 30	7.5	m	c	c	9.5	9
Miner	b	9.5	" 7	" 11	" 27	8.7	l	c	d s	8	7
Moore Early	b	8.8	" 6	" 11	" 30	8	m to l	b c	b s	8	8
Mrs. Cleveland	p	9	" 6	" 11	" 28	9	m	r b c	b s	8	8
Muskingum	b	9	" 10	" 14	" 30	9	m to l	d c	d r	8.5	8
Mystic	b	9.3	" 6	" 15	July 1	8.5	m to l	r c	b d c	9	8
Neptune	p	6.7	" 15	" 12	June 26	9	m to l	r c	d c	7	7
Nim's Seedling	p	8.8	" 18	" 15	July 2	9.8	l	r c	b s	9.2	7.5
No. 1 (Allen)	p	8.7	" 12	" 11	June 27	6.5	m	r c	b c	9	8.5
No. 3 "	b	9.4	" 11	" 18	" 28	8	l	r c	b c	9	8.5
No. 5 "	p	8	" 8	" 12	" 30	9	m to l	r d c	v d c	9.5	8.5
No. 6 "	p	9.5	" 11	" 11	" 26	7	l	r c	d c	9.8	9
No. 13 "	p	8.9	" 8	" 11	" 27	9.5	m to l	r d c	v d c	9	9
No. 14 "	p	8.3	" 10	" 12	" 26	8	m	l c	l s	9	7.5
No. 3 (Belt)	b	9.5	" 11	" 14	" 29	9.2	l	c	b l s	9	8
No. 2 (Cameron)	b	7.8	" 10	" 13	" 27	9.4	l	l c	b c	9	9
No. 6 "	p b	9.5	" 11	" 14	" 30	8.7	l	r c	b s	9	7.5
No. 13 "	p	8.4	" 17	" 16	July 2	8.5	l	r c	d c	7.5	8
No. 1 (Engle)	b	9	" 15	" 16	" 1	8	m to l	i r	l c	8	8
No. 2 (Feicht)	b	4.5	" 8	" 12	June 27	9.2	l	r c	c	9	8
No. 3 "	p	9	" 8	" 14	" 29	9	l	i c	l c	8.8	8
No. 31 (Haynes)	p	8.5	" 8	" 13	" 27	6	l	i r c	b s	7	7
No. 2 (J. S.)	b	8.6	" 8	" 14	" 27	6	l	r c	c	8	7.5
No. 4 "	p	8.5	" 8	" 11	" 27	9.4	l	b c	d s	8.5	9.5
No. 6 "	p	8.5	" 11	" 14	" 28	9.6	l	r c	b d s	7	6
No. 18 (Little)	b	8.8	" 7	" 13	" 26	6	m	r c	b d c	8	9
No. 26 "	b	9.2	" 8	" 29	July 7	9	l	i	b d s	9	8
No. 42 "	b	8.8	" 11	" 14	June 28	9	l	r c	d c	9.5	8.5
No. 1 (Roser)	b	9.5	" 8	" 11	" 28	9.5	m to l	r c	d c	9.5	7.5
No. 1 (Stayman)	p	8	" 15	" 10	" 26	9.5	m	r o	l s	8	8
No. 34 (Thompson)	p	8.8	" 12	" 12	" 28	5	m	r c	b c	8	8
No. 64 "	b	8	" 11	" 11	" 28	9	m to l	i r c	b d s	8.5	9
No. 77 "	b	8.5	" 10	" 9	" 23	9.5	s	l c	b c	7	5
Odessa	p	8.8	" 19	" 14	" 29	9	v l	r or b c	l s	8	7.5
Ohio Centennial	p	9	" 19	" 16	July 1	9	l	b c	d s	9	8.5
Ohio Monarch	b	8	" 19	" 14	June 27	5	l	l c	b s	9	8
Ontario	b	9.4	" 19	" 17	" 25	9.4	m to l	c	l c	9	8.5
Parker Earle	b	8.5	" 8	" 13	" 28	9	m	l c	d s	8	9
Pawnee	b	8.5	"	" 11	" 27	6	l	r c	d c	8	8.5
Primate	b	8	" 9	" 15	" 27	8.2	l	l c	d c	9.2	9
Princeton Chief	p	9.1	" 11	" 17	" 27	8.8	l	l c	d c	8.5	8.8

TABLE No. 1.—STRAWBERRIES.—CONCLUDED.

Variety.	Sex.	Vigor (1-10).	Date of bloom.	First ripe fruits.	Last fruits.	Productiveness (1-10).	Size.	Form.	Color.	Quality.	Firmness.
Princess	p	7.5	May 7	June 11	June 26	5.3	m	r	s	9	8.5
Sadie	p	7.8	" 7	" 4	" 27	8.8	m	r c	d c	9	8
Sandoval	b	8	" 11	" 12	" 28	9	l	r c	v d c	8.5	9
Saunders	b	9.4	" 11	" 13	" 30	8	m to l	l c	b s	7	8
Seedling B	p	9.7	" 11	" 11	" 28	9.4	l	r c	s	7.5	7
Sharpless	b	9.2	" 11	" 12	" 28	8	m	b c	b c	8	8
Smeltzer's Early	b	9	" 8	" 11	" 26	5	l	r c	d c	9	8
Southard	b	8.3	" 6	" 13	" 27	8.5	m to l	r c	d s	8.5	8
Standard	b	8.2	" 8	" 11	" 27	8.8	l	r c	d c	9	8
Stevens	b	7.6	" 11	" 11	" 27	7.5	m	r c	d c	9	8
Stimmel No. 15	p	9	" 10	" 9	" 26	8.5	m	b c	l s	9	8
Stimmel No. 20	p	8.5	" 11	" 11	" 26	6	s to m	l c	d c	9	8
Surprise	b	8.5	" 7	" 11	" 28	8.5	l	l c	b s	8	8.5
Swindle	p	8	" 7	" 11	" 29	9	m to l	r c	c	7	9
Tom Walker	p	8.3	" 7	" 11	" 27	9	l	r c	d c	9	8
Topeka	b	8.5	" 8	" 13	" 28	8.5	m to l	l c	d c	8	8.5
Van Deman	b	7	" 5	" 4	" 27	6	m	r c	l c	8	8
Westbrook	p	7.5	" 6	" 13	" 26	4	s	c	d c	7	8.5
West Lawn	p	8.8	" 11	" 14	" 27	8	m	l	d s	6	8
Weston	p	9.5	" 14	" 13	" 30	9.8	l	b c	b s	8	8.5
Williams	b	8.7	" 14	" 13	" 28	9.4	m to l	r c	d c	8.5	9.3
Wilson	b	8.4	" 12	" 11	" 30	8	m	c	d c	8	9
Woolverton	b	9.4	" 9	" 11	" 29	8.5	m	l c	d c	8	9
Wyoming	b	7.8	" 10	" 13	" 29	8.5	l	r c	l s	9	9

NOTES ON VARIETIES.

The following varieties fruited for the first time the past season:

America.—Plants from Cleveland Nursery Co., Rio Vista, Va. The plants are of fair growth, but make few runners. A large amount of fruit set for growth of plants. The berry is of very handsome appearance and regular form. It is of high quality and sufficient firmness to make a good shipper.

Bird.—Plants from W. F. Bird, Ann Arbor, Mich. The plants are of strong, vigorous growth, sufficient to ripen a large amount of fruit. The crop was at best June 21. The berry is large, long conical in shape, and of bright, dark scarlet color; seeds prominent and flesh firm, making it an excellent berry for shipping. It is of good quality. A promising sort.

Bowman.—Plants from Cleveland Nursery Co. The plants did not start well after setting and made few runners. The berry is large, round conical, of good quality, but not firm. The light scarlet color and lack of firmness are against it.

Brandywine.—Plants from Edward T. Ingraham, West Chester, Pa. The plants are of very vigorous growth, set and ripened a large amount of fruit. The crop was at its best June 22. The berry is very large, round conical, dark crimson color, and of very high quality. The berries are lacking in firmness and often the large ones are hollow. Promising for home use or near market.

Chairs.—Plants from J. T. Lovett, Little Silver, N. J. The plants are of strong growth, healthy and productive. The fruit is of good size and fine appearance but is somewhat lacking in quality and firmness.

Charlie.—Cleveland Nursery Co. Plants of strong growth; blossomed full but did not set much fruit. Fruit of medium size, regular form, good appearance, of excellent quality, and quite firm. The variety is lacking somewhat in productiveness, but is well worthy of trial.

Childs.—Plants from Matthew Crawford, Cuyahoga Falls, O. Plants of medium growth, blossomed very full and set a large amount of fruit. Crop at best June 21. The fruit is large in size and of a bright crimson color. Its productiveness, handsome appearance, high quality, and firmness promise much for it as a valuable market variety.

Dan Bisel.—Plants from Dan Bisel, Tonti, Ill. No variety exceeds this in vigor of growth and plant-producing qualities. Crop at best June 18. The plants are very productive. The form is somewhat irregular but the quality is good and the berries are firm. Very promising as an early market sort.

Jay Gould.—Plants from Chas. A. Green, Rochester, N. Y. Plants are of good growth. Crop at best June 20. The plants are productive; the berry of good size, regular form, high in quality, and quite firm. A promising market berry.

Judsonia.—Plants from John Little, Granton, Ontario. The plants are of fair growth and moderately productive, but the berries are light colored and lacking in quality and firmness.

Long John.—Plants from Thomas Wilde, Herrington, Mich. The plants grow vigorously in hills, but produce very few runners. Crop at best June 22. The fruit is of good size, very long conical form, and of bright crimson color; the quality is good and the berry is moderately firm. The hills produce a large amount of fruit. The variety is difficult to propagate.

Luther.—Plants from W. F. Allen, Jr., Salisbury, Md. Plants are of medium growth. The fruit is of high quality and moderately firm but the plants were lacking in productiveness.

No. 5 (*Allen*).—Plants from W. F. Allen, Jr. Plants are not of strong growth. The berry is of good size and regular form. The color is dark crimson and the quality excellent. Its handsome appearance and high quality make it desirable for home use. The plants are moderately productive.

No. 6 (*Allen*).—The plants are of strong growth but did not set much fruit. The berry is large in size, handsomer in appearance, and better in quality than No. 5, but not as productive.

No. 13 (*Allen*).—Plants are of good growth, blossomed full, and set a large amount of fruit. Crop at best June 20. Fruit of good size, fine appearance, regular form, good quality, and firm. Productive. Perhaps the best of Allen's tried here and a very promising sort.

No. 14 (*Allen*).—Plants are not of very vigorous growth. Berry medium in size, long conical, with neck, light scarlet color, quality good. The plants lack in productiveness and the berry is rather soft and light colored.

No. 1 (*Roser*).—Plants from E. L. Roser, Brittain, Ohio. Plants of strong growth. Crop at best June 23. Fruit of good size, attractive appearance, and high quality, but not very firm, and the berries are often hollow. Productive.

No. 64 (*Thompson*).—Plants from Cleveland Nursery Co. Plants of medium growth but set well with fruit. Crop at best June 23. Fairly

productive. The berry is irregular in form, often coxcombed. The fruit ripens unevenly and often has a hard core.

Princeton Chief.—Plants from Slaymaker and Son. Plants of medium strong growth. Crop at best June 21. Fruit uniformly large in size, long conical form, and of good appearance. Medium in quality, firmness, and productiveness. The berries usually have a hard core.

Sandoval.—Plants from Matthew Crawford. Plants of medium growth. Fairly productive. Berry large in size, good form, firm, and quite handsome in appearance. A berry of fair promise.

Seedling B.—Plants from J. Little. Plants of very strong growth, healthy and productive. The fruit is large in size, but the color is light and the berry lacks in quality and firmness.

Bulletin No. 100, published in August, 1893, contained notes on eighty new varieties of strawberry. Another season's trial of these sorts, during which the original plants set in 1892 and a new setting in the spring of 1893 have fruited, should give data sufficient to form a fair idea of their respective merits or demerits.

Of the eight varieties placed in Group 1, as possessing points of superior excellence and deserving of a place among the best sorts, *Clyde*, *Greenville*, *Leroy*, and *Weston* are all that is claimed. *Clyde*, *Leroy*, and *Weston* are very productive, the berries are of good form, handsome in appearance, and firm enough to stand shipment well.

Greenville, while well up in other qualities, is scarcely firm enough to carry well; it is, however, an excellent near-market berry. *No. 2* (*Feicht*) and *Topeka* (*Stayman No. 3*) are excellent sorts and well worthy of trial as home-market berries. A further trial is necessary to fully determine their place. The light color of the *Epping* (*Yankee Doodle*) detracts from its appearance as a market sort, otherwise the variety ranks high.

Allen No. 1 is attractive in appearance and of high quality, but the past season's mark was far below that of the previous year in productiveness.

Several varieties placed in Group II, as having many points of merit but requiring further trial to determine their place, have proved worthy of special mention.

Afton is a promising market sort. The berry is of handsome appearance, good quality, and firm. The plants are strong, healthy, and very productive. It well deserves a place among the best sorts.

Belle of Lacrosse has again shown itself to be among the first in productiveness. The plants are strong-growing and healthy. The berry is medium in quality and firmness. An excellent near-market sort.

Brunette, because of its fine appearance and very high quality, well deserves a place in every garden. It is fairly productive and the fruit is quite firm.

Iowa Beauty is another sort valuable for table use, though the berry is not as firm nor the plants as productive as Brunette.

Huntsman is productive and strong and healthy in plant growth. The fruit is attractive in appearance and of good quality. Were the berries firmer it would be an excellent market variety. It is worthy of trial for local market.

No. 2 Cameron shows up well as a market berry. The plants are not very strong-growing but bear a good crop. The fruit is of good quality and firm.

No. 4 J. S.—Last season this variety did not show more than average merit. This year it was exceeded by few sorts in productiveness. It

possesses all other qualities necessary, and should it continue to be productive it would be a most valuable market berry.

Weston.—By an oversight Weston was not included in the planting made two years ago. In the old patch (second year fruiting) the plants were remarkably free from blight and the most vigorous in the plantation.

Williams.—Last year the plants rusted badly. This season the plants were sprayed and the variety made an excellent showing as a market sort. Its good points are productiveness, firmness, and attractive appearance.

The following varieties have much of promise in them, but further trial is needed before determining their place:

Banquet,	Hermit,	Nos. 26 and 42 (Little),
Beverly,	Leader,	Odessa,
Bickle,	Lincoln,	Primate,
Clark,	Nim's Seedling,	Standard.
Gypsy,	No. 3 (Belt),	

The following list includes sorts that have some good points, but they are so deficient in others that there is little hope of their ever occupying a prominent place among the standard varieties:

Accomac,	Leviathan,	No. 18 (Little),
Alabama,	Magnate,	Pawnee,
Cameronian,	Mystic,	Southard,
Clark Seedling,	Neptune,	Stevens,
Cheyenne,	No. 3 (Allen),	Smeltzer's Early,
Fairmount,	No. 6 (Cameron),	Surprise,
Glenfield,	No. 13 (Cameron),	Westlawn,
Hattie Jones,	No. 3 (Feicht),	Wyoming.
Katie,		

The varieties named below have little or no merit and will be placed in the rejected list:

California,	E. P. Roe,	Nigger,
Dayton,	Harmon,	No. 1 (Engle),
Dr. Moriare,	Hyslop,	No. 31 (Haynes),
Estelle,	Lillie Monroe,	Ohio Monarch.

A few brief notes upon the comparatively new, yet longer tested, sorts should be given. The reader is referred to the table for further data concerning their qualities.

Beder Wood, in vigor of plant growth and productiveness, is exceeded by few varieties. It is the equal of Crescent in firmness and quality. The flowers produce an abundance of pollen; it is therefore an excellent pollenizer for the early pistillate sorts.

Belle, Gen. Putnam, Hoard, Muskingum, Swindle, and Woolverton have proved themselves valuable market sorts. Woolverton is especially valuable as a pollenizer for the later pistillates.

Edgar Queen and Mrs. Cleveland are vigorous and healthy in plant growth, are productive, and the fruit is of fair quality. In planting for local market they might profitably have a place.

Enhance as a berry for either local market or shipping purposes stands well toward the head of the list. Its irregularity of form and not ripening well at the tip are its only bad qualities.

Parker Earle, under high culture and in a favorable season, is likely to be the most profitable variety that could be selected for market purposes. It is not a good plant producer and the plants often lack sufficient vigor to ripen the large crop of fruit.

Sadie and Stayman No. 1 are well worth a place in the home garden or for near market.

The old varieties, Bubach, Crescent, Haverland, Warfield, and Wilson are still the choice of the great majority of the growers for market purposes. Perhaps the time is near at hand when the Crescent and Wilson will be superseded by the newer sorts, Bubach, Haverland, Parker Earle, and Warfield.

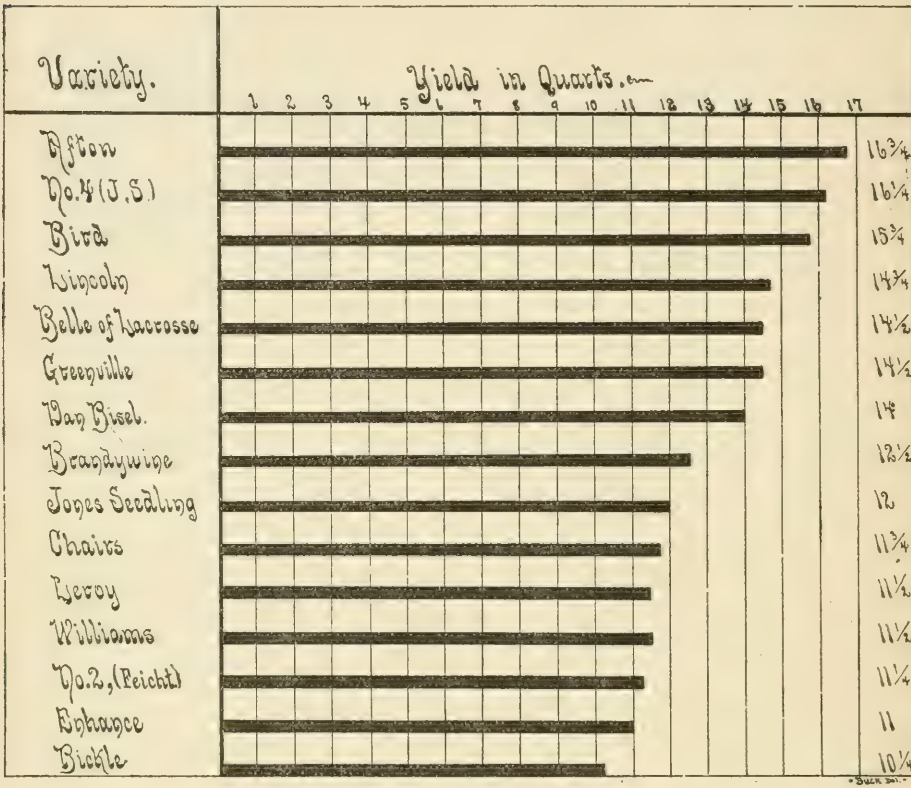
As pollenizers for the pistillate varieties, Cumberland, Miner, and Sharpless are the most commonly used, though Beder Wood and Woolverton might be a better choice.

In the table below is given the date of picking and the quarts picked of fifteen of the more productive sorts among the newer varieties. By dividing the season into two periods and giving the yield for each division of time, an attempt has been made to show which are valuable as early varieties:

TABLE NO. 2.—YIELD FROM 40 FEET OF ROW, IN QUARTS.

Variety.	June 12.	June 14.	June 16.	June 18.	Total yield, June 12-18.	June 19.	June 20.	June 21.	June 22.	June 23.	June 25.	June 27.	Total yield, June 19-27.	Total yield for season.
Afton	¾	3	----	6	9¾	----	...	4	2½	----	½	----	7	16¾
Belle of Lacrosse	----	----	----	1¼	1¼	----	1½	----	5¾	----	4½	1½	13¼	14½
Bickle	----	1	----	5	6	----	1	¾	2	----	1	----	4¾	10¼
Bird	----	½	----	5	5½	----	1½	2¼	4	----	1½	1	10¼	15¾
Brandywine	----	----	1½	3½	5	----	1¾	----	3¼	----	2	1½	7½	12½
Chairs	½	¼	----	7	7¾	----	1	----	2½	----	½	----	4	11¾
Dan Bisel	½	½	4	5½	10½	----	2½	----	1	----	----	----	3½	14
Enhance	----	----	4	----	4	----	3½	2½	1	----	----	----	7	11
Greenville	----	2½	----	4½	7	----	3	----	1½	----	2½	½	7½	14½
Jones' Seedling	1½	1½	----	6½	9½	----	----	1¼	¼	----	1	----	2½	12
Lincoln	½	1¼	----	7	8¾	----	2	----	----	----	3	1	6	14¾
Leroy	½	----	----	4	4½	----	3½	----	2½	----	1	----	7	11½
No. 2 (Feicht)	1	---	----	4½	5½	----	2½	----	2¼	----	1	----	5¾	11¼
No. 4 (J. S.)	¼	2½	----	6	8¾	----	3½	---	1½	----	2½	----	7½	16¼
Williams	----	----	1½	----	1½	2½	----	3¾	----	2¾	1	----	10	11½

The diagram below shows at a glance the relative productiveness of the varieties in the above table.



RASPBERRIES.

The raspberries suffered much from the dry weather and severe heat during the ripening season. The bearing period was so shortened by the drouth that the dates of last ripening of fruits is omitted.

BLACK AND HYBRID RASPBERRIES.

ABBREVIATIONS.

Size.	Form.	Color.	
s, small.	r, round.	b, black.	g, glossy.
m, medium.	c, conical.	p, purple.	l, light.
l, large.	o, ovate.	o, orange.	pu, pubescent.

Variety.	Vigor (1-10).	Date bloom.	First ripe fruits.	Productiveness (1-10).	Size.	Form.	Color.	Quality.
Ada	9.2	June 5	June 30	8.5	m	r	g b	8
Caroline	9.5	" 4	July 1	7	m	r	l o	8
Columbian	9.5	" 14	" 14	9.5	l	r o	p	8.5
Conrath	9.5	" 4	June 30	9	l	r	b	8
Cromwell	9.	" 2	" 27	7.5	m	r	b	8
Ebon Beauty	8.5	" 4	" 29	7	m	r c	b	8
Farnsworth	9	" 2	July 1	8.5	l	r	b	8.5
Gregg	9.5	" 4	" 4	8.5	l	r	b pu	7
Hopkins	8.5	" 5	June 29	8	m	r	b	8
Jackson's May King	9.	" 2	" 28	7.5	s	r c	b	8.5
Johnston Sweet	8.5	" 4	" 30	7	m	r	g b	8
Kansas	9	" 3	" 28	8.5	l	r	g b	8
Lovett	8.8	" 2	" 29	7.5	m	r	b	9
Nemaha	9.2	" 4	July 3	8.5	l	r	b pu	7
Norfolk	8	" 2	June 29	6	s	r	b	8.5
Ohio	9.5	" 4	" 30	8.5	l	r	b	6
Older	9.2	" 1	July 2	9.5	l	r	b	9
Palmer	8	" 1	June 28	8.5	m	r	b	8.5
Progress	8	" 1	" 27	7	m	r	b	8.5
Shaffer	9.4	" 7	" 30	7.5	l	r o	p	8.5
Smith (Prolific)	9.5	" 4	July 1	9	l	r	b	9
Surrey	9	" 2	" 2	9.2	l	r	b pu	8.5
Virginia	9.4	" 2	June 28	8.5	l	r c	b	8.5
Winona	9	" 2	" 28	6.5	m	r	b	8
Wonder	8.5	" 3	" 29	7	s	r	b	8

NOTES ON VARIETIES.

Ada.—The bush is quite vigorous and bears a moderate crop of good-size berries.

Columbian Red.—This was the latest variety to ripen fruit. The canes are of strong growth and healthy. The berry closely resembles Shaffer, but is firmer and of better quality. The bushes were productive. A promising variety.

Conrath.—The vigorous cane growth, productiveness, and large size of the berries make this sort one of the most promising black-caps.

Cromwell.—A desirable early ripening variety.

Farnsworth.—The plants are vigorous, healthy, and productive. The berry is large, firm, and of good quality. Promising as a variety for home use or market.

Kansas.—Lacks hardiness. The canes are of quite vigorous growth and moderately productive. The fruit is of large size.

Lovett.—Not likely to occupy a prominent place among the newer early ripening sorts.

Norfolk.—Did not do well the past season.

Older.—Bush of vigorous growth and productive. The fruit is of large size, rather soft, but of high quality. A promising sort for home use.

Palmer.—A good early market variety.

Progress.—Similar to Palmer, but the bushes are not so productive.

Smith (Prolific).—The bushes are of strong, vigorous, healthy growth. The berry is large, jet black, not very firm, but of good quality. A promising variety.

Surrey.—Bush of vigorous growth, and quite productive. Fruit resembles Gregg, but is not so late in ripening. Promising.

Virginia.—Bush a vigorous grower, hardy and productive. A promising early ripening sort.

Gregg and *Nemaha* are among the best late market sorts.

Ohio is one of the best medium-season market sorts. It is very hardy and productive. It is the leading variety for evaporating purposes.

Shaffer.—For canning and home use this variety has no superior among the better known sorts.

Ebon Beauty, Jackson's May King, Wonder, and *Winona* have not been sufficiently tested here to judge of their merits.

RED RASPBERRIES.

ABBREVIATIONS.

Size.	Form.	Color.	
s, small.	r, round.	d, dark.	o, orange.
m, medium.	c, conical.	r, red.	b, bright.
l, large.	o, ovate.	p, purple.	

Variety.	Vigor (1 to 10).	Date bloom.	First ripe fruit.	Productiveness (1 to 10).	Size.	Form.	Color.	Quality.
Arnold	9	June 5	July 4	5	v l	o	b r	9
Belle de Fontenay	6	" 8	" 3	3	l	r c	b r	9.5
Brandywine	8.5	" 7	" 4	6	m	r c	d r	8.5
Cuthbert	9.5	" 7	" 4	9	l	r c	r	8
Gladstone	8.5	" 6	June 30	5	s	r c	d pu	8
Golden Queen	9	" 8	July 1	6.5	l	r c	o	9.5
Hansell	8	" 4	June 28	7	m	r	d r	9
Herstine	7.5	" 7	" 28	6	m	r	b r	9.5
Lost Rubies	8	" 8	" 28	6	l	r c	b d r	9.5
Marlboro	8.5	" 6	" 30	7	m	r	r	8.5
Michigan Early	9	" 2	" 26	8	m	r	r	9
Miller's Woodland	8.5	" 7	July 3	6	m	r	r	8.5
Philadelphia	7	" 4	June 28	6	l	r c	d r	9.5
Rancocas	7.5	" 6	" 29	7	m	r	r	8.5
Red Cluster	8.5	" 8	July 1	8.5	m	r c	r	9
Royal Church	8.5	" 5	" 3	7	l	r c	d c	8.5
Scarlet Gem	8	" 8	June 28	6	m	r	b r	9
Talcott	8.5	" 6	" 26	5	m	r	d r	8
Thompson Early	8	" 6	" 28	6	m	r	d r	9
Turner	8.5	" 4	" 30	7	l	c	r	9

NOTES ON VARIETIES.

Cuthbert.—The plant is vigorous and healthy. This variety has yet no superior for general planting. It is valuable either for home use or for market.

Gladstone.—This variety, in addition to a small crop in the usual season, furnished two pickings the middle of October. The variety has little to recommend it for general planting.

Golden Queen is clear, bright yellow in color and of high quality. It is a desirable variety for the home garden.

Hansell and *Michigan Early* are hardy in plant, and as early ripening sorts may be planted to a limited extent.

Royal Church.—The berries have the fault of falling to pieces very easily. The bush is hardy, of vigorous growth, and fairly productive.

Turner is valuable for the extreme hardiness of the plant and the mild flavor of the fruit.

NATIVE PLUMS.

U. P. HEDRICK.

Bulletin No. 123.

Native plums have received but little attention in Michigan. In fact, until the exhaustive study of them made by Prof. Bailey of Cornell, a few years ago, but little had been done elsewhere, and the literature upon the subject was scant and fragmentary. Within the last few years, however, they have been coming somewhat into prominence, but there is still a great difference of opinion among fruitgrowers as to their merit. In a small way they are successfully grown in various parts of the state, and the indications are that large plantations of the better kinds could be made profitable in some localities and under certain conditions. At any rate they deserve to be better known by Michigan fruitgrowers.

The market demand for them is still somewhat limited, but is steadily increasing for the better kinds, and the careful grower who has access to the large markets, or who controls a small select trade, will find no trouble in disposing of his crop. Good fruits of the American plums come into the markets at least three weeks before the European varieties are marketable. They command prices, when choice and in small packages, ranging from $2 to $4 per bushel. While the demand for the earliest varieties is greater, yet the later ones have qualities which commend them as well worth attention.

The native plums have many qualities which make them desirable for the general farmer or for home use. The trees of most of the varieties are hardy, vigorous, and very productive. The fruit comes early, keeps well, and has a fine appearance, and, though poorer in quality and inferior in size, is very acceptable as offering a greater variety of fruits. A strong point with those who grow them in a small way is their comparative immunity from insects and fungous diseases.

NATIVE PLUMS AT THE EXPERIMENT STATION.

It is doubtful if a much more comprehensive orchard of native plums can be found than this station's plantation. It consists of 80 trees, embracing 35 of the better varieties planted in the spring of 1886, the trees having been obtained of D. B. Wier of Lacon, Ill., and T. V. Munson of Denison, Texas. The soil of the orchard is a well drained clay loam, having a stiff subsoil composed of gravel and clay. The trees were planted 18 feet apart each way. Crops of vegetables have been grown in the

orchard every season, so that the ground has received good cultivation. The manuring has consisted of an occasional application of composted barnyard manure. This treatment has produced a healthy, vigorous growth of trees and productiveness in fruit. The trees, which have been remarkably free from diseases, bore their first fruit in 1890, and the increase in quantity has been rapid, nearly all the trees bearing a large crop last season.

PROPAGATION AND CULTIVATION.

In propagation, the common stocks, Marianna and myrobalan are largely used. The various varieties work well upon *Prunus Americana* and other native species, though the Chickasaws are said to be undesirable because of their habit of sprouting and sending out suckers. *Prunus Americana* stocks are especially suitable for northern climates, because of their hardiness. In the south the peach is largely used.

Methods of planting and cultivation need not vary from those employed with the common plums, except that, as many of the varieties of native plum are not fertile, owing to the impotency of the pollen upon flowers of the same variety, the prospective grower must bear in mind that, with native plums in particular, he must practice mixed planting in order to secure their fertilization. Some of the best kinds, including Wild Goose and Miner, are worthless unless so planted. It is a matter of some difficulty and considerable importance, to determine what varieties should be planted near each other, in order to have the best mutual effect as pollenizers. No definite rules for planting can be given without further experimentation, and about all that can be said is that trees of different varieties blooming at the same time should be planted near each other. They can be so planted that a tree of a very polleniferous variety will fertilize several barren trees. Some growers maintain that the mutual fertilizing trees should be planted very close, eight or ten feet apart, but experience here does not lead us to think close planting is at all necessary. Prof. Bailey says that it is a "common opinion among plum-growers that the European plums, peaches, and even the cherry will fertilize the Wild Goose plum" and a case cited seemed to lend color to the view, but the writer knows of three Wild Goose plum trees that stood in the midst of an orchard of several varieties of common plum and a row of cherry trees bordered the plum orchard, but not a plum did the Wild Goose trees bear, and the trees were finally cut down by the owner. This shows at least that considerable care must be observed in planting trees to fertilize those that are not self-fertile.

SOILS AND LOCATIONS FOR NATIVE PLUMS.

Michigan has considerable territory that is admirably adapted to growing these plums. Undoubtedly the country adjoining the great lakes, especially that northward, is capable of greatest development for this industry, as it is favored by soil, climate, and immunity from insects and diseases. As a class, the native plums are not particular and will thrive on various soils, although extremes in sand, clay, or muck must be avoided. In an ideal soil, the trees should make a hard, strong growth, the wood should mature early and well, the trees should bear young, and the fruit should be well-flavored and highly colored.

The climate of Michigan is suitable for growing most of the native plums, in any part of the state except, perhaps, in the central and northern portions of the upper peninsula. In the north, especially where it is at all frosty, it is well not to plant trees on a southern exposure where the buds may start and be nipped by a late frost.

It is easy to produce an overgrowth in the native plums; if they run too much to heavy tops and foliage they are not so productive of fruit, the wind easily breaks them down, and they do not bear so early. Such overgrowths are caused by a soil too strong or by the use of nitrogenous manures in large quantities.

CHARACTERISTICS OF NATIVE PLUMS.

There are over 150 named varieties of native plum scattered throughout the country; experimenters are annually introducing seedlings, and since any very promising wild plum tree may be the beginning of a new variety there is still abundant material to draw from. There are several groups of the plums, the distinctive lines of which have been drawn with considerable accuracy. But the rapid multiplication of varieties from seed, many the product of natural crosses, has made intermediate forms so numerous, and complicated the classification so much, that it is a difficult matter to assign varieties to their true positions. Because of this, and since a scientific classification is not strictly necessary for commercial purposes, a brief description of the varieties must take the place of a detailed classification.

It is not easy to give even the general characteristics of the native plums. There are, even in varieties of the same group, manifold variations in the character of the trees, flowers, and fruits. Following the classification given in Bulletin 103, there are five groups of interest to Michigan growers.

Clinton.—Fruit medium to large, round, oblong or elliptical; skin thick, mottled with dark red; flesh firm, flavor sweet and pleasant; stone clinging, circular, smooth; leaves large, serrate, pointed, with glandular stalks; trees vigorous and very prolific; season early to medium, from August 1 to 15.

De Soto.—Fruit large, round, somewhat oblong; skin thick, dark red, and with a heavy bloom; stone large, roughish, rather broad; stem $\frac{3}{4}$ inch long, slender; cavity broad and shallow; suture a line; flesh firm, flavor sweet and good; leaves oblong oval, medium size, acute, serrate, stalks glandular; season early, last of July and first of August. One of the best of the American plums.

Forest Rose.—Fruit large, round, a little oblong, and sometimes pointed; skin thin, red or purple; flesh firm, quality good; stone clinging, broad, smooth, flat; leaves obovate, pointed, finely serrate, stalks glandular; trees with spreading, open heads and thorny branches; not prolific on the station grounds; season medium, August.

Garfield.—Fruit small to medium, oblong oval; skin rather thick, very dark red; cavity small and shallow; fruit stems long and slender; suture a dark red line; flesh firm, juicy, yellowish, flavor acid, pleasant; leaves large, ovate-lanceolate, finely serrate, stalk glandular; trees weak in growth and unproductive; season very late, September and October.

Itaska.—Fruit small, oblong oval; skin dark red, thick, and tough; flesh firm, stringy, quality poor; leaves large and thick with glandular stalks; trees dwarf in habit with massed foliage of a peculiar pinkish tint; characteristics of the tree very prominent; season medium to late; of little if any value.

Maquoketa.—Fruit medium size, round, oblong; skin tough, dark red, purple bloom; stone clinging, short, pointed, rough; leaves large, smooth, dark green, stalks glandless; stem short, stout, in a very shallow cavity; suture prominent, dividing the plum into halves; season late, the fruit colors early but is a long while in maturing. A poor variety.

Marianna.—Fruit small to medium, round; skin thin, bright red speckled with white; flesh soft, juicy, flavor mildly acid, insipid, poor; stone clinging, rough; trees much branched with long slender twigs; leaves oblong lanceolate, small, finely serrate, dark green; season early, last of July and first of August. Of little value.

Miner.—Fruit large, round, oblong; dark red skin, mottled, thick and tough; flesh firm, sweet, quality good; stone clinging, round, smooth; leaves large, serrate, stalks glandless; trees vigorous and prolific; season medium. An old and popular variety. Miner and Clinton are almost identical, differing only in foliage.

Moreman.— Fruit small, round; skin thick, dark cherry red with a yellowish tinge opposite the sun; flesh firm with a pleasant acid flavor; stone small, circular, a little pointed; leaves rather large, ovate with a long point, serrate, dull green, stalks glandless; trees thrifty, vigorous, and quite free from fungous diseases; season late, fruits not ripening at the same time.

Newman.—Fruit medium to large, round, somewhat oblong, inclined to be irregular; skin thin, light bright red, without bloom, dotted with spots near the apex, and with a yellow cheek opposite the sun; stem short and slender, cavity small; suture a bright red line; flesh firm, juicy, fibrous, adhering to a small, flat, rough stone; flavor acid, pleasant; trees thrifty, large, round topped, foliage good; leaves large, oblong-ovate, acuminate, finely serrate; season medium. The best variety of the Chickasaw plums.

Pottawattamie.—Fruit medium to large; skin thin, bright red with yellow streaks running partly around the fruit; stem long and slender; flesh firm, juicy, quality fair; cavity small, suture a red line; leaves conduplicate or trough-like, oblong lanceolate, small; stone, large, broad, rough; growth slender, spreading, zigzag; tree very vigorous, prolific; season early, August.

Purple Yosemite.—Fruit medium to large, round; skin thick, bitter, tough, dark red or purple, covered with bloom; flesh firm, yellowish, stringy; flavor acid, good; stone large, flat, smooth, inclined to be free; leaves large, ovate, smooth, dull in color; growth upright, strong, spreading into stiff branches; trees productive; season, August.

Rollingstone.—Fruit large, round, somewhat flattened at the ends; skin tough, pinkish purple, mottled; flesh firm, sweet, good; stone clinging, circular, flat, smooth; leaves large, serrate, smooth, stalk slender, glandular; cavity broad, shallow, suture a line; trees very vigorous and prolific; season early or medium, being about that of De Soto.

Robinson.—Fruit medium size, round, oblong; skin thin, dull red with yellow blotches opposite the sun; flesh firm, juicy, reddish, quality good; stem short, slender, set in an abrupt narrow cavity; leaves small, oblong lanceolate, stalk short; trees spreading, not branching so much and shoots not so zigzag as in the typical Chickasaw, very prolific; season, August and early September.

Yellow Yosemite.—Only a shade of difference between this and Purple Yosemite, the color being some lighter than that plum with a quite decided

yellow tinge; tree and foliage differ but little, season about the same, perhaps a few days later.

Weaver.—Fruit large, oblong-oval; skin thin, yellow, mottled with red; flesh firm, flavor excellent, sweet; stone large, flat, smooth, pointed, cling; leaves large, toothed, pubescent underneath; stalk short, glandless; cavity large, suture distinct; season late, end of September. The most popular of the late kinds.

Wild Goose.—Fruit large, oblong-oval, apex pointed; skin thin, bright red; flesh not very firm, a little stringy, quality fair; stone clinging, long, pointed; leaves oblong-lanceolate, closely serrate, acuminate, stalks with several glands; shoots smooth, slender, spreading; trees very thrifty and productive; season early, August. Because of earliness, productiveness, and handsome appearance of fruit, one of the best of the native plums.

SUMMARY.

1. Within the last few years native plums have been coming somewhat into prominence. The opinions of fruitgrowers differ as to their merit.

2. The market demand for them is limited, although it is steadily increasing for the early kinds. They come into market about three weeks before the European varieties.

3. The station has tested 35 of the better varieties, which were planted in the spring of 1886, the trees being obtained from D. B. Weir, Lacon, Ill., and T. V. Munson, Denison, Texas.

4. In propagating native plums, *Marianna* and *myrobalan* stocks are largely used. *Prunus Americana* is well adapted as a stock for northern climates.

5. Methods of planting and cultivation do not differ from those used with common plums except that mixed planting must be followed in order to secure the fertilization of many of the native plums.

6. Native plums are not particular as to soil, although extremes in sand, clay, and muck should be avoided. A soil too strong or too rich in nitrogenous matter causes a heavy growth of foliage at the expense of productiveness.

7. There are about 150 varieties of native plum, embraced in five species, of which the most important are *Prunus Americana*, *P. hortulana*, and *P. angustifolia.*

8. The most valuable of the native plums are De Soto, Rollingstone, Weaver, Wild Goose, Miner, and Newman, of which Wild Goose, De Soto and Miner are probably the most popular.

9. In general the native plums are to be recommended to those who want plums for an early market; because of their immunity from diseases and insects, to the general farmer; and to large growers who want a greater variety of fruits.

RUSSIAN CHERRIES.

U. P. HEDRICK.

For a number of years considerable interest has been shown in Russian fruits. Several importations have been made and some of the kinds are promising for the colder portions of our country. A few varieties promise well for milder regions and bid fair to furnish our general horticulture with fruits of value.

The introduction of Russian cherries into the United States dates from 1882, when Prof. Budd of Iowa and Mr. Charles Gibb, a Canadian horticulturist, visited Europe and made selections of what they considered the best varieties growing in the colder portions. The trees were taken to Iowa and Canada, where the hardiest of the common cherries fail utterly, and in both places proved hardy. Prof. Budd's trees in Iowa were one year old when imported, and were set in an orchard where the dry summers and cold winters had killed all the common cherries, including the hardy Early Richmond and English Morello.

With this treatment the Russian cherries grew and thrived, notwithstanding the fact, too, that they were severely cut for scions and buds.

The trees were soon well distributed among the experiment stations, and several reports have been made concerning their peculiarities and values, with varying opinions as to their general worth. Through the stations and the usual channels of trade they have now been quite generally distributed to the public, and some of them are highly spoken of by practical growers, who say that they have many points of usefulness for the general fruitgrower. In our state, with a few exceptions, they will not be in great demand except in the upper peninsula, and in the northern inland portions of the lower peninsula, where the common cherries fail to grow. For these regions, as a good substitute for the other cherries, they are recommended. They are also commended to those who live in localities where late frosts make the cherry crop uncertain.

The general grower who desires a larger variety of fruit will find among the Russian cherries varieties which approach the common cherries in size, appearance, and quality. They come very late in the season and this may be a point in their favor with some growers.

It is the object of this bulletin to give information regarding the hardier and more promising sorts that have been tested on the station grounds and which will be desirable for growing in sections where the common kinds fail.

The history of Russian cherries on the station grounds is as follows: In the spring of 1888, thirty trees, embracing twelve varieties, were obtained from Prof. Budd of Iowa. The soil of the cherry orchard is the same as that upon which the American plums were grown, and the trees

have received the same care and cultivation. The trees are vigorous, strong, and healthy; they first bore fruit in 1891, since which most of the trees have borne every year.

CHARACTERISTICS OF RUSSIAN CHERRIES.

There are now scattered through the country almost half a hundred named varieties of Russian cherry. There are several groups of them, but the distinctive lines are not as yet well drawn; and as the intermediate forms are numerous, a proper classification would be difficult and will not be attempted. The aim will be to give only a few general characteristics of the cherries and as accurate a description of the varieties as is possible.

The nomenclature of the Russian cherries is badly confused. In Russia different names are given to the same fruit in different localities, while the same name may be given to different fruits growing in adjacent districts. The names, though very formidable to an English-speaking person, are quite simple and without any individuality, mostly expressing some quality of the fruit, such as sweet, transparent, white, round, etc., and it is not easy to convert them into good English names. Then again, seedlings of like parentage resemble each other so much that it is difficult to distinguish between varieties. However, most of the names used in this bulletin have now become pretty well fixed.

The most distinct characteristics of the Russian cherries are their dwarf, compact habit of growth; their small and narrow leaves which are thick but finely textured; and, in general, a deep purplish-red or reddish-black fruit of a peculiar bitter, yet often very pleasant, flavor. As grown by the peasants in Russia the trees are generally of bush form, as they receive but little care, seldom any cultivation, and are often grown in dense thickets. Sometimes they are planted under other trees as our currants are. They are usually grown from seed and in sod, though seedlings vary much from the parent, so that the best trees are grown from sprouts. Grafting is rarely practiced. Some of the trees are erect in growth though the weeping form is usually considered better. With such careless cultivation, it can easily be seen that, if profitable in Russia, with the comparatively careful cultivation which we would give them they ought to prove profitable for us. In the main the trees have the same characteristics here as in Russia, except that the bush form is never grown. The trees are dwarf, compact, and vigorous in growth. Leaves and flowers appear later, and the fruit ripens later than with the common cherries. The fruit is borne in small bunches and tends to remain for a long while on the trees, even after ripening.

The following are the more promising kinds that have been tested on the station grounds:

Bessarabian.—Fruit rather large, roundish, heart-shape, irregular; borne in pairs, stalks long, slender; cavity deep, suture distinct; when fully ripe, dark red in color; flavor acid, slightly astringent; pit medium size, round; trees dwarf, shaped like May Duke; foliage good, leaves small, coarsely serrate. One of the hardiest and most prolific of the Russian cherries.

Griotte du Nord.—Fruit medium size, round, slightly heart-shape; borne in pairs, stalk long, slender; dark red in color; flesh firm, reddish, flavor quite acid, slightly bitter; pit small, round; tree very hardy and vigorous, quite dwarf and compact in habit and a slow grower. It is much

like Bessarabian, differing mostly in habit of tree and flavor of fruit. Season, midsummer.

George Glass.—A variety similar to and identical with Bessarabian. Introduced from eastern Europe to Iowa by immigrants; it was discovered in Marshall county.

Lithaur Weichsel.—Fruit small and rather poor, round; suture distinct, cavity deep; stalk long and slender; skin thick, dark purple, almost black; flesh firm, reddish, juice colored; flavor acid and bitter, quality poor; pit very small; tree strong and vigorous. Used only for culinary purposes; season last of July.

Sklanka.—Fruit large and handsome, color yellow with red cheek; flesh firm, yellowish; flavor sub-acid, good; pit small and somewhat flat; tree well formed, round topped, branches drooping, foliage good; a handsome tree producing an abundance of excellent fruit.

Brusseler Braune.—Fruit large, globular, slightly heart-shape, a little inclined to be irregular and to vary in size; in color very dark red; flesh firm, reddish, acid, and slightly bitter; stalk long, cavity deep; pits large and flat; tree very vigorous and prolific, shoots ascending, foliage good; season middle of July. One of the best of the Russian cherries.

Ostheim.—Fruit about the size of the Richmond; heart-shape; dark red or brownish black when ripe; skin thick; cavity deep, stalk long, suture obscure; flesh firm, but tender, juicy; flavor mildly acid, very good; pit large, somewhat flattened; trees vigorous and hardy, round topped, resembling the Morello type; season 20th July to the end of July. One of the best known of this class of cherries.

Schatten Amarelle.—This cherry is almost identical with Brusseler Braune. It is, perhaps, a little smaller, not quite so globular, and not so dark in color, and is a few days earlier. But in flavor, appearance of tree and foliage they are alike in every respect. Like the Brusseler Braune it promises to be one of the best of this class of cherries.

Lutovka.—In appearance the fruit of the Lutovka resembles the Sklanka very much. The quality, however, is better, as it lacks the astringency of the Sklanka; the season is later. The trees of the two varieties resemble each other in shape, but Lutovka is a stronger grower, with coarser shoots and foliage.

SUMMARY.

1. The introduction of Russian cherries into the United States dates from 1882, when Prof. Budd of Iowa and Charles Gibb of Canada imported a number of varieties from Russia.

2. Russian cherries are recommended for those localities in Michigan which are too cold for the common cherries. They are for these regions a good substitute for common cherries. Since they ripen very late, they may, for this reason, find favor with the general grower.

3. The chief characteristics of the Russian cherries are: A dwarf, compact habit of growth; small, narrow leaves, which are thick and finely textured; and a deep purplish-red or reddish-black fruit; and a peculiar astringent flavor which is often very pleasant; leaves and flowers appear later and the fruit ripens later than those of the common cherries.

4. The following varieties do best on the station grounds: Bessarabian, very hardy and prolific; Brusseler Braune, fruit large, tree vigorous and prolific; Ostheim, one of the best known of the Russian cherries.

THE APPLE ORCHARD.

BY L. R. TAFT.

Bulletin No. 124.

A few years ago the apple crop in Michigan was of large commercial importance and the fame of Michigan apples reached all parts of the country. For a number of years the crop has been small and in some seasons has not been sufficient to supply the local demand. While other causes may have contributed to the loss of the crop, neglect, or at least lack of proper care, can be charged in many cases with being the principal reason for the loss. Letters are frequently received inquiring as to the best methods of planting and caring for an orchard, the soil and fertilizers needed, and the remedies for the insects and diseases to whose attack the apple is subject; and to supply an evident desire for information on the subject, this bulletin has been prepared.

HISTORY OF THE APPLE.

Although there is no direct evidence as to the origin of our cultivated varieties of apple, they are supposed to have been derived from the wild crab, which is common in all parts of temperate Europe. Improved varieties of this fruit were certainly in cultivation long before the Christian era, as Pliny and other writers of his time speak of the apple as one of the fruits of the Romans, who were said to have brought it from Armenia. Even in those times varieties were plentiful, as Pliny enumerates twenty-two, including sweet, dessert, and cooking sorts, and one kind that was seedless.

The apple was carried to all parts of the empire where Roman garrisons were established, and undoubtedly thus reached England. When this country was settled, seeds, scions, and trees were brought over, and from the orchards then or soon after planted many of the varieties of today have been derived. While a few varieties now in cultivation have been brought directly from Europe, most of the kinds commonly grown are of American origin and have come as chance seedlings from older sorts. In many cases it is probable that they are the result of natural crosses, but in a few cases artificial crossing has been practiced.

As a rule when apple seeds are planted, many of the trees obtained will be thorny and will give strong evidence of their origin. Most of them will produce small fruits that will be inferior to those borne by the original

variety, but occasionally one will be obtained that makes a strong growth, has large, healthy foliage, and produces an abundant crop of large fruit that is of excellent quality. Out of thousands of seedlings it is seldom that a sort is obtained that is better than the older varieties.

Much better results can be expected if cross-fertilization is resorted to. This is brought about by selecting two varieties that have the qualities desired, and conveying the pollen from the anthers of one to the pistil of the other. To insure that no other pollen gains entrance to the pistils, the flowers in which they are should have the anthers removed before the petals open and should then be covered with small paper sacks, until several days after the crossing is done, to prevent the pollen from other flowers reaching the pistil.

THE FAILURE OF THE APPLE CROP.

Barrenness in an orchard is in many cases due to the natural tendency of the variety, as some varieties are very shy bearers, while the Northern Spy, among others, is often condemned for barrenness from the fact that the trees are late in coming into bearing.

In the eastern states, the apple has "odd and even" bearing years. This is due to the fact that upon the bearing years all of the energies of the trees are exerted in developing the crop of fruit, so that no buds are formed on the fruit spurs for the next year's crop, and as a result the following will be an "odd year." This is quite generally the case in old, neglected orchards, that are poorly supplied with plant food. The bearing year can be changed if in any way the tree is prevented from developing a crop of fruit, as can be done by destroying the blossoms or small fruits, since the trees will then be able to develop buds for the next year's crop.

Aside from the above, the partial failure of the apple crop in Michigan for the past few years may undoubtedly be ascribed to a variety of causes. A very large proportion of the orchards in the southern part of the state are now quite old and have been growing for years in sod. Many of them have in the past borne several large crops of fruit, which have drawn heavily on the soil, while in very few cases have steps been taken to return to the soil the plant food taken out by the trees. Added to these reasons we have the total absence of care in many cases, besides the injury that must result from improper pruning and unfavorable location. As if this were not enough to insure failure, various climatic conditions have combined to bring about the same results, and their effect in some years has been so great that the crops have been lost even when other conditions were favorable and the trees were well cared for.

When we have an even climate, the trees can withstand very low temperatures, but if the trees are poorly ripened in the autumn, or if the weather of January or February is such that the sap starts and the buds swell, great harm may be done by zero weather.

In some seasons we have had cold rains lasting a number of days just as the foliage and buds were appearing. As a result the pollen is washed from the anthers, so that the trees are not only prevented from fruiting, but the cold weather may give them a serious check from which they will be a long time in recovering.

The above conditions are particularly favorable for the development of fungi, and to the apple scab fungus we may attribute much of the failure of our orchards to bear, as, while other conditions were favorable, the crop

has been lost. The tender flowers are attacked on the ovary or pedicel and almost invariably they drop from the fruit spurs.

In the weak condition of the trees, the foliage is often severely injured; if any of the fruits set, they are likely to be attacked and, unless fungicides are applied, will be small and misshapen.

Some have ascribed the failure of the apple crop to the changes in climate due to the cutting off of the forests, and from the above it may be seen that indirectly this may have had much to do with the loss.

NOTES ON APPLE CULTURE.

The question of apple-growing interests nearly every farmer, apples are a crop that is easily grown, succeeding in most localities and furnishing, at a small expense in time, a large amount of nourishing and healthy food for the family.

While it is desirable that every person who is the owner of even a village lot should have trees enough to supply fruit for his own use, it is not wise to undertake the growing of this or any other fruit for market, unless it is quite certain that the natural conditions are favorable and one is well posted as to the best methods of handling the orchard.

Success in apple culture for commercial purposes can only be secured when one chooses a suitable location and soil, selects good varieties and good trees, properly plants and cares for them, supplies the needed plant food, fights the insects and fungi, and harvests and places his crop on the market in good condition, and it should not be expected unless the above conditions are complied with.

Letters of inquiry upon one or all of the above points are frequently received, and, as they indicate a wide-spread desire for information, the following notes have been prepared. They contain not only the results of our own experience, but the methods recommended are those practiced by our most successful orchardists.

ADAPTATION OF MICHIGAN TO APPLE CULTURE.

Michigan has for many years held a high place as an apple-growing state, as her success at various national and state fairs, when her apples came into competition with those from other states, abundantly testifies. The fruit is large in size, of high color, rich flavor, and has good keeping and shipping qualities. For a number of years, for reasons mentioned above, the crop has been but a partial one.

While suitable locations for an apple orchard can not be found on every farm, there are few townships in the counties south of Gladwin where apples can not be grown successfully. In the northern and central counties in the lower peninsula, while the soil is generally rather light, there are some orchards that are in a fairly flourishing condition. Many orchards in the upper peninsula also seem to be doing well.

For the past four or five years, the better part of the apple crop has come from the counties north of Muskegon, taking about two tiers from the shore of lake Michigan. Among the reasons for this it may be mentioned that the soil is new and has not been robbed of its plant food by grain and other crops. The trees are generally young and vigorous and are seldom started by warm weather in winter. Growth begins in the

spring about ten days later than in southern Michigan and the blossoms are less likely to be injured by the spring frosts, while the cold rains that have for several years nearly destroyed the crop in the southern counties by washing the pollen from the flowers and offering favorable conditions for the development of fungi, have come before the flowers have opened on the trees in the northern counties.

The insects are less plentiful in that section and a crop can be expected with considerable certainty on account of the easy transition from autumn to winter and from winter to spring.

SOIL AND LOCATION.

For a commercial orchard it is of the utmost importance that the soil and location should be well adapted to the growth of the trees. It can be put down at the outset that apples will not thrive in a soil that is very dry and sandy, or very heavy and wet. It is often said that apples will do well on any high, strong, well-drained soil, that will grow good wheat or corn, and this will generally be found to be true.

While it will always be well to avoid either extreme, a moderately heavy sandy loam or a light clay loam will generally prove satisfactory if suitably located.

The orchard should be considerably elevated above the land surrounding it, not only because that may aid in securing good soil drainage, but, of even more importance, because of its aid in giving proper air drainage, as the cold air will flow down to the lower levels and thus lessen the danger from extreme cold in winter and from spring frosts. Another advantage not generally understood is that the scab and other fungi are more troublesome in hollows than upon hillsides.

DRAINAGE.

Few plants will make a satisfactory growth, if at any time during the growing season their roots are in standing water, and the apple is no exception. While it is better to have the soil naturally drained, tile underdrainage should be supplied in case the water does not drain off quickly after a rain. If lines of two and one half or three inch drain tile are laid at a depth of three and one half or four feet, midway between the rows of trees, they will quickly rid the land of surplus water.

The objection is often made that they will fill up, but this seldom happens except to such lines as carry the water from a spring. In that case there will generally be water in the tiles while the soil around may be dry, and the roots will be very likely, under those conditions, to enter at the joints of the tiles and fill them so completely as to stop the flow of the water. When, however, the only duty of the tiles is to carry off the surplus water in the soil, the roots will seldom enter, as there will be all the moisture they care for in the soil so long as there is water in the tiles. With our common fruits, there will seldom be an exception to this rule, but the willow and elm sometimes completely fill tiles even when the soil is very wet.

It does not follow that a stiff, heavy soil, even though it be high and rolling, can be brought into good condition for an apple orchard, even though it be thoroughly tile drained, as at best it will be stiff and lumpy.

The expense will be considerable, and the result will be less satisfactory than when the trees are set upon land that is naturally drained. While it will be advisable and even necessary to drain such land, in case circumstances make it desirable that it be used for an apple orchard, it will generally be preferable, if one is to plant a commercial orchard, to choose a location that has good natural drainage.

PREPARATION OF THE LAND.

At the time of planting, the land should be in good tilth and well supplied with plant food. As a rule, in case the land needs to be artificially fertilized, it is preferable to apply the manure to a previous crop, such as corn or potatoes; or, if there is no particular hurry, if the land can be seeded to clover and the sod turned under, it will be in the best possible condition for planting.

The plowing should be deep, and if there is a stiff subsoil near the surface it will pay to use a subsoil plow along the lines of the rows, although, as noted above, it is not advisable to use this kind of soil for a commercial apple orchard. Having brought the land into a good condition for planting, it is ready for the trees.

SELECTION OF TREES.

The success or failure of the orchard will depend largely upon the varieties and the character of the trees purchased.

While many experienced orchardists wisely prefer a strong one-year tree, to anything that is older, as it enables them to form the head at the height and in the manner they prefer, for the ordinary planter a somewhat larger size is to be commended. As a rule the two-year, medium, four to five feet, five eighths to three quarter inch trees will do as well, or better, than those of a larger size, and the cost and expense for boxing, freight, and planting will be materially less than for the three or four-year-old trees that some planters insist upon having. The No. 1, two-year trees, graded as five to seven feet, three quarter inch and upward, are as a rule not objectionably large.

While it is desirable to obtain trees at a reasonable price, cheapness should not be the only consideration. When buying trees of the abovementioned sizes, care should be taken that the nurseryman does not work off cull trees that are three or four years old. By supplying such trees and, even worse, if he is unscrupulous, substituting worthless varieties, a nurseryman or tree dealer is often able to make a low price that will tempt the purchaser, who in the end will find that the trees would have been dear as a gift. The fact that a healthy tree of a good variety may in good seasons return a crop worth from ten to twenty or more dollars, while the crop from a poor tree, even if it lives to come to maturity, may not be worth gathering, should show every one that too great care can not be taken in selecting the varieties and trees, when planting an orchard.

In the present days of low prices, trees for an orchard can be obtained for a comparatively small sum. If only a few trees are needed, it may be well to secure them from a local agent, whose stock came from a responsible nursery, as the cost for packing and express upon a small bundle might be more than his commission, but if from one hundred to five hundred trees are needed it will be better to get them directly from a nursery.

As a rule, the trees should be brought from the nearest reliable nursery, when good trees of the kinds wanted can be obtained at a reasonable price. If they have to be shipped in the cars, however, it will make but little difference whether they are sent 50 or 150 miles, so far as the distance is concerned. In selecting a nursery, however, it is well to choose one with the soil and climate as much like those where the orchard is located as is possible, but from the fact that some sections do not have nurseries or they are not reliable, it often becomes necessary to go some distance for the trees. If the trees needed can not be found in some local nursery, it will be well to send a list of the numbers and varieties required to several reliable firms, and obtain estimates as to the cost.

For not less than five hundred trees of standard varieties, medium-size two-year, the cost should not be more than six or seven cents each, and the first-class trees should not be more than eight cents. When smaller numbers are wanted, the price will range from eight to fifteen cents, according to size of trees and number wanted.

These prices are the highest that should be paid, as many reliable nurseries quote prices by the thousand considerably less than those given. It must not be forgotten, however, that these prices are for trees at the nursery, and that there will be an additional charge of nearly one cent per tree for small lots, for boxing and packing, and perhaps as much more for freight.

SEASON FOR PLANTING.

At whatever time trees are planted, it will be found well to give the order early in the fall, as there will be less chance of receiving trees that have been culled over, and the best trees and best varieties picked out. If a large purchase is to be made it will be well to select the trees early in the autumn, and arrange that they shall not be *stripped* until the leaves begin to fall. It is the custom in large nurseries to strip the leaves from the trees before digging. This is the proper thing to do if the time for it has come, which is generally by the middle of October, but in order to get the work done the stripping is often performed before the wood is properly ripened. The soft, green, watery shoots are unable to withstand the winter and the trees may be severely injured, especially if the winter is a severe one.

In case the land is thoroughly drained, and yet reasonably moist from the autumn rains, fall planting is upon many accounts preferable, as the trees will become established, while the roots will have callused and will be ready to throw out new fibres by the time growth starts in the spring.

One great trouble with spring planting is that the warm weather often comes on so quickly after the frost is out of the ground, that the planting may not be completed until the buds have started, and at the best this is likely to give them a check. If planting is delayed until spring, the trees should be heeled in. For this purpose a trench should be dug in some well-drained place, one foot deep and three feet wide, generally running north and south, in which the trees should be placed. They are preferably set leaning to the south, and should not be so thick that the roots will be in contact. The soil should be pressed firmly about them and for tender trees the lower half of the trunks should be covered. Straw and rubbish of all kinds should not be left near them, as it will invite the field mice which may girdle and spoil the trees.

DISTANCE FOR PLANTING.

The majority of planters err on the side of planting at too small distances. Some advise planting closer upon strong land than upon that which is light, but while more space is desirable to furnish the necessary moisture on a light soil, on the other hand it may be urged that upon the heavier soil the trees will make a much larger growth and the branches will interlace unless they have a good distance.

Leaving the character of the soil out of the question, we may say that the strong-growing, long-lived sorts should have at least forty feet each way, while the small and comparatively short-lived kinds, such as the Wagener, may be as near as two rods without danger of crowding.

The usual method is to plant in squares (Fig. 1) but the arrangement either in rectangles (Fig. 2), or in triangles (Fig. 3) will often utilize the

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*   *        *  *  *  *        *   *   *   *
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*   *                             *   *   *   *
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Fig. 1.—Squares. **Fig. 2.—Rectangles.** **Fig. 3.—Triangles.**

land to better advantage. When varieties like the Northern Spy, that are a long time coming into bearing, are planted, it is a good plan to have each of these permanent trees in the center of a hexagon with six or of a square containing eight trees (Fig. 4, A and B) of some variety that

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   o   o   o   o              o   o   o   o   o

o   x   o   x   o             o   x   o   x   o

   o   o   o   o              o   o   o   o   o
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Fig. 4 A.—*x*, Northern Spy; *o*, Wagener. **Fig. 4 B.**

bears early, but is generally short-lived. In this way there will be one Spy to three of the others. The Northern Spy trees should then be 45 feet each way if in squares, or 40x45 if in hexagon. This plan can only be recommended when the land is to have extra care and the surplus trees are taken out when the others need the room.

As a rule the planting of peaches or other fruits between the rows is not to be commended, unless more than usual care and fertilization are given, especially as there is danger of leaving the other fruits too long. Above all, it is poor policy to grow strawberries or raspberries between the rows of trees after the latter come into bearing, or at any time in fact, as none of them will receive the amount of food or water required for a satisfactory growth.

THE PROPAGATION OF APPLE TREES.

The ordinary standard apple trees are propagated by budding or grafting the improved varieties upon seedling stocks. The seedlings are grown for one or two years in the seed bed, from seeds obtained from the cider

mill, by washing out the pomace, or from imported French crab seed, which is preferable, unless it is known that the seed is from strong-growing, hardy varieties.

If the trees are to be grown by budding, the seedlings are dug in the fall and heeled-in in the cellar or in some well drained place out of doors and there kept until spring. The soil for the apple nursery should be strong, moist, and yet well drained. While the supply of plant food should be sufficient to promote a strong, straight, healthy growth, it should not be supplied with large amounts of undecomposed stable manure, as that would induce a watery growth that would not ripen.

As soon as the soil is dried off in the spring it should be deeply plowed and thoroughly fitted for the seedlings which, after the fibrous roots have been removed and the others cut back to a length of seven to nine inches, will be ready for planting.

They should be set, either with a spade or a dibble, in straight rows from three feet eight inches to four feet apart, at intervals of from six to ten inches. The greater distances will give the best trees, but with strong soil and good care a good grade of tree can be obtained if somewhat closer together. During the first season they will need to be frequently worked so that the ground will be kept loose and the moisture conserved. With good care they should be ready for budding by the last of July or the first of August. The scions are obtained from the growth of the present year and should have plump, firm, well-developed buds. The process of budding and the care of the young trees in the nursery is the same as given for the peach in Bulletin 103 and reprinted in the Report of the State Horticultural Society for 1893.

Propagation by Root-grafting.—The process of root-grafting differs from budding principally in that, instead of a bud attached to a small piece of bark, several buds, attached to five or six inches of scion, are so fastened to the stock that a union takes place and one part develops the root while the other produces the stems and leaves of the future tree.

Root-grafting is usually done by the nurseryman during the winter when the other work is less rushing. The usual method is by what is known as whip grafting, although other methods may be used.

Whole or Piece Roots.—The more common practice today is to cut up the roots of the seedlings into from two to four pieces from two to four inches long, and use these as roots for the scions. It is claimed by some that the proper way is to graft at the collar and thus get but one root from each seedling. It is urged in favor of the whole-root graft that not only are better nursery trees produced, but that in the orchard the trees will get a better start and that the trees that have been collar-grafted will have a tendency to throw strong roots of the nature of tap roots deep down into the soil, while the short piece roots, and especially the second and third cuts, will form but few roots and these will be mostly of a fibrous nature and develop in the surface soil. By rooting deeply the trees will be much less likely to be injured by a severe winter and will suffer less from drought. While much depends upon the soil in which the trees are grown and the nature of the variety, many of the claims made for the whole root certainly hold good. As compared with those grown from the first or upper cut there will be but little difference in the growth of the nursery trees, and this will depend upon the length of the piece root. As a rule, however, the nursery tree grown from the whole root will

have rather more branching roots, but the difference will be so small that in the orchard it will not be noted after the first year. With most varieties, the trees grown from the second, third, and fourth cuts will be noticeably smaller and will have poorer roots. In the case of some of the stronger-growing kinds, like the Red Astrachan and Ben Davis, the trees will after the first year send out a number of roots from and above the graft, which soon get ahead of those from the root, so that in their case the whole root has but little, if any, effect. Many western nurserymen prefer to use the short root, as they claim that when the whole root is used the trees make a late growth in the nursery and are often winter-killed. It is true that the stocks cost less when piece roots are used, and the trees can be more cheaply planted and dug; but as a rule more trees can be sold from an acre and they will often grade larger, so that, after all, the cost of growing these trees will not be much more than when piece roots are used.

From our experiments it would seem best to use a generous length of root at any rate and in no case make more than two cuts.

The question is often asked as to the relative value of budded, whole-root, and piece-root trees, and it may be stated that as a rule budded trees one year from bud are often as large and on some accounts are preferable to grafted trees that are two years from the graft. Whole-root trees are also generally larger than piece-root trees, but between budded and whole-root grafted trees there is little difference, and they are as a rule to be preferred to those that are grown from piece roots.

Top-Worked Trees.—In case of some of the weak-growing sorts and those that are not entirely hardy when budded or root-grafted, it has been found that they will do much better when they are top-worked, or grafted at the height of four feet upon some strong, hardy stock. This may be done in the nursery, but as a rule they can not be purchased in this form and it becomes necessary either to purchase trees of the kind it is proposed to use as the stock and after growing them for a year, either in the garden or planted in the orchard, to whip-graft them with the desired sort.

Dwarf Apples.—While only desirable for growing as curiosities, or in case one has but a limited amount of ground, it may be well to explain just what is meant by dwarf apple trees. Any variety may be grown in this way, but they differ from standard trees of the same variety by being grafted upon some small-growing species of apple, which tends to so check the growth that the size of the trees is much reduced. When very small trees are desired, the stock selected is the Paradise apple, and when worked upon this the trees are seldom more than four feet in height and bear at an early age; in case a somewhat larger apple is desired the Doucin apple is used as the stock.

VARIETIES OF APPLE TO PLANT.

So much depends upon the proper selection of varieties for planting, that it should have careful consideration. If one has a neighbor who is a successful grower of apples upon soil similar to that to be used for planting, it will be well to make a careful study of the varieties as they ripen, and in this way one will be able to determine quite accurately the kinds it will be best to buy.

The character of the soil has so much to do that no one can recommend a list that will apply in all sections of a township even, but there are many well-known kinds that are generally grown with success and it will be better to plant them than to rely too much upon the advice of the average tree agent or the nursery catalogue.

A different selection should be made for home use from what would be planted for market, as in the former case it is desirable that the selection should be such as will give a succession throughout the season. There should be varieties adapted both for dessert and cooking purposes, and sweet apples for the different seasons. While the hardiness and the productiveness of the varieties should be considered, care should be taken that the list contains dessert varieties of high quality for the different portions of the year.

As a list for family use the following would be desirable: Red Astrachan, Bough (Sweet), Oldenburgh, Primate, Chenango, Keswick, Maiden Blush, Shiawassee, Twenty Ounce, Bailey (Sweet), Westfield, Jonathan, Hubbardston, Grimes, Baldwin, Talman, King, R. I. Greening, Red Canada, Northern Spy, and Golden Russet. While in some sections it might be well to leave out a part of these kinds and substitute others, the list will be found as a rule to answer as well as any that can be made.

When designed for commercial purposes other things should be considered. Among the requirements for a commercial variety, in addition to the vigor and productiveness of the tree, may be mentioned the size and color of the fruit. It should be a good keeper and should ship well. In securing these qualities the flavor of the fruit should not be lost sight of. While in the past the size and color have sufficed to sell fruit that was inferior in quality, the public are each year becoming more and more fastidious, particularly regarding their dessert fruit, so that although a fruit poor in quality may be sold to a man once, he is less likely to buy the same kind a second time. Moreover, the apples of high quality will sell for a higher price and more readily than others of the same size and color but of an inferior quality.

As a rule the list for commercial planting should be a short one and for the most part it should consist of winter varieties.

For local markets a few summer sorts may be grown, and there are a few of the late autumn kinds that are worthy of growing upon a large scale, and among them are the King and Shiawassee, or Snow where the latter succeeds well.

The list given for a family orchard contains the cream of the varieties, and almost any of the summer or autumn sorts may be grown with profit for sale upon a small scale; but to follow the King it would be well to select not over two or three of the following kinds: Northern Spy, Baldwin, Red Canada, Hubbardston, Jonathan, Wagener, and Westfield. The Northern Spy is as reliable as any of them, but the trees are a long time in coming into bearing; Wagener and Jonathan are particularly valuable in some sections but they require extra care, as otherwise the trees are likely to produce small, inferior fruit from their tendency to overbear. The Baldwin in high, well-drained locations is generally successful but is often injured by severe winters upon low land. The Red Canada is a poor orchard tree when root-grafted, but grafted standard high upon a strong stock it is very popular in many sections of the state.

DESCRIPTION OF VARIETIES.

Red Astrachan.—One of the most valuable and best known of the Russian apples. It is said to have been imported into England from Sweden about 1816. The tree is vigorous, hardy, and a regular and abundant bearer. Shoots spreading and ascending, stout and brown. Foliage thick, large, and healthy. Fruit medium to large, roundish-oblate or slightly conical, regular. Skin greenish yellow, nearly covered with crimson, mottled and striped. Stalk one half to three fourths of an inch long, inserted in a regular cavity of medium depth; basin medium, nearly regular; calyx nearly closed. Flesh white, crisp, and juicy, rather acid. One of the best culinary apples of its season, which is early August.

Bough (Sweet).—One of the best early sweet apples, highly valued for eating. Tree vigorous, round-headed, and quite productive. Fruit conical-ovate, regular, greenish yellow with a few small brown dots. Stem rather long, in a deep, acute cavity, which is sometimes russeted; basin of moderate depth, narrow; calyx small, closed. Flesh white, tender, and juicy, with a very sweet, sprightly flavor. Season, August.

Oldenburgh.—This is a Russian variety that is highly esteemed on account of its hardiness and productiveness. The tree is of only medium size, round-headed, and an early bearer. Fruit of medium size, regular, flattened. Skin a waxy yellow nearly covered with stripes and splashes of red and carmine, with a light bloom. Cavity regular, acute; basin shallow, rather wide, generally irregular; calyx large and closed. Flesh yellowish-white, tender, juicy, and sub-acid. An excellent culinary sort and fair for eating.

Primate.—Tree vigorous, strong, and stocky, shoots short and stout; buds quite prominent; fruit of medium size, roundish and slightly conical, angular and irregular, yellowish green; when ripe nearly white with a slight blush; cavity narrow, pointed, irregular; stem medium to long; basin abrupt and irregular; eye long, but small and closed; flesh white, tender, and juicy, with a mild sub-acid flavor. Quality very good. One of the best family apples, lasting from August to October.

Chenango.—Tree a vigorous grower, spreading, but with an upright tendency; fruit medium to large, long conical, angular; yellowish white, nearly covered with stripes and splashes of bright carmine; cavity narrow and deep, pointed, stem medium; basin narrow, abrupt, folded; eye medium closed. Flesh nearly white, tender and juicy, with a mild sub-acid flavor. Generally quite productive and valuable either for dessert or cooking. Season, September and October.

Keswick.—Tree strong and vigorous. A very early bearer and quite productive; fruit medium to large, oblong conical, truncated, ribbed; cavity acute; stem medium long, slender, deep-set; basin medium, irregular, calyx quite large; skin greenish yellow, sometimes with a light blush; juicy and acid, excellent for cooking. It is especially valuable for home use as it can be used from July to November.

Maiden Blush.—A handsome, vigorous, and productive spreading tree; fruit medium to large, regular, flattened; pale yellow with a handsome blush of deep carmine covering half the fruit; cavity wide and deep; stem rather short; basin shallow and regular; calyx closed, small; flesh white, tender, sprightly, fine-grained, sub-acid, aromatic. Rather too sharp for most persons as a dessert fruit, but excellent for cooking. An early and sure bearer. Season September and October.

Shiawassee.—Tree a strong, upright grower, becoming somewhat pendent when full grown; young wood reddish brown; fruit medium size, regular, flattened; skin greenish white, nearly covered with stripes and splashes of deep red; basin wide, corrugated, eye medium, close; calyx reflexed; cavity wide; stem short; flesh very white, tender, sprightly, aromatic, pleasant sub-acid; quality very good. A seedling of Fameuse, which it resembles, but the tree is more upright and the fruit is larger, and much less injured by scab than is that variety. Season October and November.

Twenty Ounce.—Tree a hardy, thrifty, compact grower, and a regular bearer; fruit very large, regular, or slightly ribbed, round-conical, smooth; yellowish green, nearly covered with rich red, splashed and striped with scarlet; basin regular, abrupt; eye small, closed; calyx long and reflexed; cavity wide and deep; stem short; flesh white, granular, juicy, and rather acid. Rather coarse and of poor quality, but a good cooking apple, while its size and color cause it to sell well. Season October to January.

Bailey Sweet.—Tree hardy, vigorous, and productive; fruit large, round or slightly conical, obscurely ribbed; bright red with indistinct stripes on yellow ground; dots large and numerous; basin narrow, abrupt, plaited; eye small, closed; cavity small, narrow, slightly ribbed; stem slender, one inch long; flesh yellow, tender, but not very juicy, mild, rich, and sweet. November to February. One of the best of the early winter sweet apples.

Westfield.—Tree strong and vigorous, with fruit on young trees quite free from scab; fruit rather large, round-conical, generally regular; dull red, striped with russet and with yellow dots; stalk slender, three fourths of an inch long, in a regular cavity; calyx sometimes partly open, in a regular basin of medium size; flesh white, tender, spicy, and juicy and of fine flavor. November to February. One of the very best varieties either for home use or market.

Jonathan.—Tree a moderate grower, shoots slender and spreading; fruit of medium size, round-conical, sometimes slightly truncated, regular; yellow, nearly covered with bright stripes of bright red; stem slender, inserted in a deep and regular cavity; basin deep and rather broad; flesh white, spicy, juicy, and sub-acid. November to January. On strong soils an excellent variety, bringing the highest price in the market if well grown.

Hubbardston.—Trees strong-growing, branching; fruit large, round-oblong, slightly conical; skin yellowish, nearly covered with stripes and splashes of pale and bright red; stalk three fourths of an inch long in an acute, russeted cavity; calyx open, in a ribbed basin; flesh yellowish, juicy and tender, rich and sub-acid, excellent. November to January. Shoots rather slender, downy, and gray. Valuable in every collection.

Grimes' Golden.—Tree vigorous, hardy, spreading, and productive; shoots with swellings at the base, dull red, downy; fruit medium size, regular, round-oblong; skin a golden yellow, sprinkled with gray dots; stalk short and slender, in a deep, russeted cavity; basin abrupt and irregular; flesh yellow, fine grained, firm, and crisp, with a rich, spicy flavor, sub-acid. November to February. Excellent for home use but, as with other yellow varieties, its color is against it for market.

Baldwin.—Tree strong, vigorous, branching, and productive; fruit large, round-ovate, flattened; greenish yellow, nearly covered with crimson, often

russeted, particularly about the stem; stem rather short, varying in size, in an even, rather deep cavity; basin narrow, plaited, calyx closed. Flesh yellowish white, sub-acid, with fair flavor. Tree a vigorous grower and in nearly all parts of the state a profuse bearer. In heavy soils, especially if low and wet, it has been found lacking in hardiness in severe winters. One of the best varieties for all purposes. Season from November to March.

Talman.—Tree very hardy and productive. One of the best cooking sorts. Generally spreading and with stout branches. Fruit round or slightly flattened. Skin yellowish white, with slight blush in the sun and a number of lines from stem to calyx. Stem long and slender, inserted in a wide but shallow cavity. Basin small and but slightly depressed. Flesh white, sweet, and of fine flavor. November to March.

King.—Tree vigorous and spreading and generally quite productive. Fruit large, round, conical, slightly angular. Skin yellow, shaded with red and nearly covered with crimson splashes. Stem large and stout, inserted in a large and irregular cavity. Calyx small and closed, in a small, corrugated basin. Flesh yellowish, coarse, but tender and juicy, with a pleasant vinous flavor, decidedly aromatic. Generally a desirable variety. December to March.

R. I. Greening.—Tree very vigorous, with large, spreading branches. Generally a profuse bearer. Fruit large and round, considerably flattened; sometimes slightly ribbed, green, becoming whitish green when ripe, with a dull blush in the sun. Stalk small, three fourths of an inch long, curved, thickest at the bottom. Flesh yellow, fine-grained, crisp, juicy, and with an aromatic, sub-acid flavor. November to February.

Red Canada.—Tree of slender growth and should be top-worked on a vigorous grower. Fruit flattened and generally conical, size medium. Skin yellow, nearly covered with deep red or crimson, generally striped and splashed, and with many large, gray dots. Stem short, in a broad, deep cavity. Calyx closed, segments long, in a small, narrow, and generally irregular basin. Flesh white and crisp, and with a pleasant flavor. Trees bear early and abundantly and need the best of care. Season December to May.

Northern Spy.—Tree a vigorous and upright grower, slow in coming into bearing, but often quite productive when ten or twelve years old. Fruit large, roundish conical, generally ribbed in the larger specimens. Skin greenish-yellow, about one half covered with stripes of dull red, with a few pale dots and a thin, white bloom. Stem three fourths of an inch long in a wide, deep cavity, sometimes marked with russet. Calyx small, closed. Basin narrow, furrowed. Flesh white, fine grained, tender, and slightly sub-acid, with a pleasing flavor. Quality very good to best. December to June.

Golden Russet.—Trees vigorous and spreading, generally with small, drooping shoots. Fruit of medium size, round or slightly flattened, conical. Skin rough, yellow, nearly covered with russet and with a bronze cheek in the sun. Stem short, small, in a medium deep cavity. Calyx closed, segments long. Basin large, broad, and corrugated. Flesh yellowish white, firm, mild, sub-acid. Quality good. Generally productive. December to June.

It has been observed that orchards where only one variety is planted are often unfruitful. The observations of the National Department of Agriculture have shown that this is because many varieties are not self-

fertile, or in other words that pollen from another variety is required for the proper fertilization of the flowers and setting of the fruit.

For this reason we would advise that in large commercial orchards, unless one is sure that the varieties selected are self-fertile, several varieties should be grown, and that no more than five or at most ten rows of any one variety be planted without introducing at least one row of some other kind. While this will to some extent injure the appearance of the orchard, and perhaps increase the labor in picking, the benefits to the crop will more than balance these drawbacks.

The same thing is known to be true of pears to an even greater degree, and is probably true of other fruits.

LAYING OUT AND PLANTING THE ORCHARD.

In locating the position of the trees a garden line or wire, with a mark of some kind at the interval determined upon for the trees, should be used, and stakes set where the trees are to go. To secure the placing of the trees at the precise spots occupied by the stakes, a planting board of some kind can generally be used to advantage. A simple form is shown in Fig. 5. It consists of a strip of board three or four inches wide and six feet long, with a notch at each end and another in the middle.

Fig. 5.—Planting board.

To use the board, place the center notch against the stake where the tree is to be set and insert stakes at each of the other notches. The board can then be removed and used at other trees in the same way. When the hole for the tree has been dug, the board is again placed so that the stakes will be in the end notches, and, if the tree is placed in the center notch, it will be in exactly the same position that the original stake occupied. In this way, if the land is carefully marked out, it will be a simple matter to have the trees in straight lines.

If, before setting the trees, the land is deeply plowed, the holes need be only large enough to receive the roots without crowding, but if this has not been done it will be well to make them three or four feet in diameter. Should it become necessay to set trees in land that for any reason is not adapted to them, it will aid them in making a start if the holes are made large and rich loam is used for filling them.

Before setting the trees, the roots should be examined, and if any of them are large and have been bruised or have rough ends, they should be cut smoothly off. Also, if they have a mass of small, hair-like roots, and especially if these have become dry, it will be well to remove them. The holes should be deep enough to allow the trees to stand an inch or so deeper than they were in the nursery. As a rule, they should be deeper on light soil than when it is heavy and poorly drained. Having adjusted the tree in the center notch of the planting board and spread the roots out evenly, the fine soil should be slowly thrown in and carefully worked among the roots, taking pains that no cavity is left beneath the tree. As soon as the roots have been covered the soil should be firmly pressed upon them, using either the feet or a wooden tamper. About three fourths of the hole should be filled in this way, but it is better to leave the surface

soil light to act as a mulch and prevent evaporation. As a rule the soil about the trees should be left level, although, in spring planting, if the land is rolling, a slight depression may be formed which will catch the water that would otherwise run off.

In handling the trees care should be taken that they are not exposed for any length of time to the action of the sun or wind, and while planting it will be desirable to heel-in the trees until needed, by covering the roots with soil, unless canvas or other coverings are used.

WATERING THE TREES.

If the soil is fairly moist it will not be necessary to apply water to the trees at the time of planting, but if a drouth prevails the use of water will generally be desirable. Even though the soil is fairly moist, water will often make the trees more likely to start into growth. To use water in transplanting trees to the best advantage, it is well to cover the roots as recommended above and then fill up the hole with the water. As soon as it has soaked in, the remainder of the soil should be placed in the hole. If at any time it becomes desirable to add more water, it is a good plan to scrape away the soil from around the trees so as to form a basin from four to eight feet in diameter according to the size of the trees, and into this from ten to forty gallons should be turned, replacing the soil as soon as the water has been taken up.

FORMING THE HEAD.

As soon as the trees have been planted they should be pruned and the heads formed. When branched trees are used, the first thing is to remove all surplus shoots, selecting the weaker ones and leaving four or five of the others arranged at intervals along the stem. Beyond this it is not necessary to go, but if the remaining shoots are long and slender it will be well to head them in from one fourth to one half. The center shoot should be left considerably longer than the others, to grow upward and develop other side shoots. A tree formed in this way, with its branches given off at intervals from a central axis, is much less likely to break down than when they start at the same height.

When one-year trees without branches are used, it will only be necessary to cut back the trees at the proper height for the branches to form. A variety of opinion exists among fruitgrowers as to the proper height for an apple tree, but as years go by it would seem as though the better fruit-growers were becoming quite unanimous that it is a mistake to have very high heads. The only exception to this rule is in sections where the snow-fall is heavy and there is danger of the branches being broken down if they are within three or four feet of the ground.

While varieties with a spreading habit may require a greater height of trunk, for the upright growers three feet is perhaps a fair height for the lower branches, while some head even lower than this.

Among the reasons for having low heads is that the branches can then prevent the burning of the bark by the sun during hot weather, also that the wind will be much less likely to turn the tree from the perpendicular. It will also be easier to prune and spray the trees and gather the fruit than when they have high trunks. About the only objection to low heads is that they interfere with cultivation, but if the side shoots are properly pruned this need not be the case.

PRUNING THE TREES.

If pruning begins in time, and is thoroughly done while the trees are small, it will greatly lessen the necessity for the removal of the large branches later on, and will thus lengthen their life. During the first two or three years the surplus shoots that start should be rubbed out and all branches that get much beyond their fellows should be cut in. As the trees increase in size all shoots should be removed from the main branches so that there will be no side branches within four or five feet of the main trunk.

While no general rules can be given for pruning that will apply in all cases, the following will be found useful: (1) Remove all dead branches as soon as they appear, cutting them back to sound wood. (2) Keep the head open enough to admit of the easy gathering of the fruit, and the entrance of the air and sunlight to the leaves and fruit on the inner branches, but avoid the opening up of the heads so as to allow the sun to enter and strike with full force upon the naked stems and branches. (3) Prune so as to secure a symmetrical head to the trees. By proper pruning a portion that is weak can be made to fill out, while the strong-growing branches can be restrained. (4) If a low, spreading variety has a tendency to carry its branches too near the ground and thus prevent cultivation, it is not necessary to cut them back to the trunk, as a point can generally be found where a side branch has an upward tendency, and if the end is cut off to this point the trouble will be obviated.

When the only pruning required is the rubbing out of surplus shoots or such cutting out as can be done with a knife, it can be done at any time; but, if it has been delayed until a saw is required, care should be taken that a suitable time is selected. While pruning may be done in any month while the leaves are off from the trees, it will generally be preferable to prune young trees during the latter part of March or the first half of April. If delayed until the sap starts, harm is often done by the sap running down the trunks and injuring the bark. Pruning at this time has a tendency to cause a development of stem and leaf, while if performed after growth has started a check is given to the growth of the trees and a development of fruit buds is promoted. For trees that have reached a bearing age, and owing to their strong growth have formed no fruit spurs, it is a favorite practice with some persons to delay the pruning until the leaves have appeared, say about the middle of May, and then give the necessary pruning.

Wounds made in the fall or winter become dried out and are much slower in healing over than those made in the spring and early summer, which is an added reason for spring pruning. If at any time it becomes necessary to remove large branches, the wound should be at once covered with paint or other material that will prevent it from drying out. By coloring it so that it resembles the color of the bark it will be less unsightly.

CULTIVATING THE ORCHARD.

It is generally admitted that some hoed crop should be grown in young orchards. In making the selection it is best to choose one that will require frequent cultivation up to the first or the middle of August, and that will not necessitate the stirring of the soil to harvest it until after the middle of October. Corn, late potatoes, squashes, and beans are among

the crops that satisfy the above conditions. The small grains are least of all adapted to the successful growth of the orchard, as they not only require large amounts of water and plant food, at the time when it is required by the trees, but they allow the soil to bake, and thus a large amount of water is wasted by evaporation. For the same reason grass and most forage crops are not suitable for the orchard, especially while the trees are small.

Under ordinary conditions it will be well to give similar care to bearing trees, until they become so large that hoed crops can not be grown among them to advantage. After that time, if the entire land is given up to the trees, the increased profits from the crop of apples will more than equal the value of the hay or grain crop that could be obtained and the expense of the cultivation they would need.

While by the use of manure or fertilizers a supply of plant food could be furnished both to the trees and the other crop, the amount of water available would seldom be sufficient for the apple crop alone, were no means taken to conserve it by frequent stirring of the soil. The trees would then make a small growth, form few fruit buds, and the fruit crop would be small in quantity and inferior in quality.

While no deviation from the above rule should be made in the case of young trees, there may be circumstances that will make it desirable with bearing orchards to seed down the land for a year or two. The grain crops should even then be avoided, but if the trees have reached a bearing age and are making such a strong growth that few if any fruit buds are formed, the land can be seeded to clover or grass and the desired check can thus be given. Upon rich, strong land, especially if there is an abundance of moisture, the sod will not be particularly injurious, and if clover is grown it will add to the fertility of the land. It will seldom be desirable to allow the sod to remain for more than two years.

Upon light soils, where it will be difficult to secure a catch of clover, it is not a bad plan to sow rye in the orchard in August and turn it under the following May. This will be a slight protection during the winter and will add to the humus of the soil when it is turned under.

Where crimson clover is hardy it is an ideal crop for this purpose, but it is doubtful if it can be successfully grown in most parts of the state. As grown here for a number of years, very few plants survive the winter. It may in time become acclimated and, even now, is perhaps worthy of trial, sowing American seed grown as far north as it can be secured, at the rate of ten pounds per acre, in August.

Upon many farms where hogs are raised, the orchards are used as hog pastures. If the hogs are given plenty of food or have a considerable range they seldom injure the trees, and as they keep the ground cultivated and destroy the apple worms by eating the fallen apples they serve a good purpose. If the range is so large that they can not keep the surface well worked it is well to supplement their work with the cultivator. Sheep can also be used in old orchards in a similar manner.

Some advocate keeping the land in grass and allowing it to fall down and remain on the land. While this will not directly take plant food from the trees, it will virtually have the same effect by lessening the amount available for them by aiding in the evaporation of moisture from the soil. The presence of the grass will also make harboring places for insects and vermin.

When orchards are cultivated without crops, it will be well to plow the land in the spring, if it is inclined to be heavy; and then, at intervals of a week or ten days during the summer, give it a stirring with some form of harrow or orchard cultivator. For this purpose, when the soil is light, we have used with good results the Acme harrow.

When the trees are large and it is desirable to work beneath them, the Pearce orchard cultivator will enable one to work the ground two or three feet further under the branches than the team can be driven.

Of the newer implements that are coming into favor is the Morgan orchard cultivator. This has been quite extensively used for several years and is generally highly spoken of.

In case the land is well drained it is best to give it level culture during the summer, working away from the trees the soil that was turned toward them when the land was plowed in the spring.

The tillage is of advantage to the trees in various ways, as it opens the soil and thus favors the admission of water which might otherwise run off; it admits the air more freely and in this way aids in the solution of plant food in the soil; the roots also are able to penetrate it more readily. Perhaps the principal gain is in conserving the water that is in the soil and preventing its evaporation. By keeping the surface soil to the depth of two inches light and open, the amount held in the soil will be increased nearly one half. This will be of great importance to the crop and in dry seasons will be equal to the addition of thousands of barrels of water to each acre of the land.

When the land is not to be cultivated it is well to place a mulch of some kind around newly planted trees to prevent loss of water.

Although it answers for this purpose, there is a serious drawback to the use of a mulch, as it draws the roots into the surface soil and renders them more likely to be injured by the winter.

MANURES AND FERTILIZERS.

One of the essentials for the successful growing of an orchard is the presence of an abundance of plant food. While land that will grow a large corn crop will have plenty of food for young trees, there are few soils that will not be benefited by an application of manure after the trees come into bearing, and if the land is heavily cropped it will generally be desirable when the trees are two or three years old.

Until the trees reach a bearing age, we need not think of using commercial manures so long as an abundance of stable manure can be obtained. From fifteen to twenty loads to the acre applied broadcast once in two years will supply any ordinary farm crop and provide food for the growth of the trees. If the trees alone are to be manured, it will not be desirable to cover all of the land with manure until the trees have reached the age of ten or twelve years. The amount used should depend on the size of the trees and should be placed over a circle with a diameter about twice that of the heads of the trees. The banking of manure about the trunks is unwise, as the feeding roots are for the most part several feet away. Upon bearing trees it is generally as well to leave a considerable space about the trunks without manure, and it is better to have the entire amount outside the circle of the branches than to have it packed about the tree.

While stable manure is desirable for young trees, it contains such an excess of nitrogen that if used by bearing trees it should be supplemented by some form of potash and phosphoric acid. While it is less likely to be injurious to apple orchards than to some of the more tender fruits, the excessive use of stable manure, especially if it is in an undecomposed form, is likely to cause a rank, late growth that may be injured by the winter. Nitrogenous manures also tend to promote growth of stem and leaf and this will be at the expense of the fruit.

While stable manure, then, can be used to advantage upon poor soils for young trees, it should be used somewhat sparingly for bearing orchards that are growing in soils fairly rich in plant food. There are, however, few soils where trees will be injured by stable manure, and one need not hesitate to make applications up to thirty or forty loads of stable manure per acre, where the trees have been grown for years without manure.

Of the mineral manures, wood ashes will be found to be the cheapest source of potash and they also supply some phosphoric acid. Their value will depend upon the kind of wood from which they were obtained, the amount of foreign matter they contain, and the extent, if any, to which they have been leached. Hard-wood ashes are worth perhaps one half more, pound for pound, than those from soft wood and, while no definite rule can be given that will fix the value of leached ashes, it is seldom safe to count them as more than one third as valuable as unleached ashes.

An average sample of unleached ashes should contain about five per cent. of potash and one and one half of phosphoric acid. This will make a bushel of ashes worth about ten to fifteen cents, according to the amount of water they contain, as compared with what chemical manures will cost. At this valuation they will be worth from five to six dollars per ton, although ashes of a known high analysis might be worth nearly twice as much.

For bearing orchards, from fifty to one hundred bushels per acre can generally be used to advantage, with smaller amounts for young trees. While the trees are quite small one peck to each will generally be sufficient. In case soft-wood ashes or those that have been leached are used the amount should be increased in proportion.

Besides their value in supplying plant food, wood ashes have a physical effect upon light soils that is of value. The carbonates of potash and soda contained in wood ashes tend to bind together the particles of soil and make it more compact. While this is of value upon sand, it has the reverse effect upon very heavy soils, especially if a considerable excess of ashes is applied.

In sections where wood ashes can not be readily obtained, the German potash salts can be used with profit. They can be obtained either as sulphates or muriates, and generally contain about fifty per cent. of potash.

The price in New York is from forty to forty-five dollars per ton. As one ton of potash salts contains as much potash as ten tons of wood ashes, it can be seen that they will be much cheaper to transport and to apply. For young trees one to two pounds will be sufficient, while two to four hundred pounds per acre will be ample for bearing orchards.

Potash has the effect of promoting a firm growth of wood which is favorable to the production of fruit buds, and renders the trees less likely to winter-kill.

While phosphoric acid can be obtained from a number of sources, for trees it is best to use ground bone. This can be obtained at about twenty-

four dollars per ton and provides a cheap source for this material. It is slowly soluble and its effects can be seen for several years. Of ground bone from two to five pounds will be sufficient for young trees, while those in full bearing will require from five hundred to one thousand pounds per acre, if they are of large size and cover all of the ground.

Another source of phosphoric acid is the dissolved rock phosphates from South Carolina. They are less valuable than the bone phosphates and the transportation charges render them little if any cheaper. As compared with ground bone, the "odorless" and other iron phosphates can not be recommended for most localities.

Nitrate of soda is the best source for nitrogen in a mineral form, but where stable manure can be obtained it will have little use. Trees will seldom need more than one to two hundred pounds of this material per acre.

It will generally be desirable to supply both potash and phosphoric acid to the apple trees and the ground bone and potash salts can be mixed and applied together. As a rule it will require two pounds of the ground bone to each pound of potash salts. When ashes are used with ground bone, it will be well to apply one to two bushels of unleached ashes to each ten pounds of ground bone.

RENOVATING OLD ORCHARDS.

Nearly all of the orchards in the state are in sod, and are in anything but a flourishing condition. They have for the most part been allowed to shift for themselves and as a result have become "hide-bound" and make but little growth and produce still less fruit.

We are often asked to recommend a course of treatment for such orchards, but the conditions vary to such an extent that what might be desirable for one orchard might not be required in another. In a general way, supposing the conditions to be as stated, we would make the following recommendations.

(1.) Cut down all trees that have gone so far beyond their prime that they have badly decayed trunks and only one or two broken branches.

(2.) From trees that have healthy trunks and promise to in a measure renew their youth if given proper care, remove all dead or dying branches, thin out surplus shoots where absolutely necessary, and attempt to bring the trees into good form. If they are badly misshapen it may be well to cut the stronger branches back severely in order to force the others into growth. If a tree of some worthless variety is fairly healthy and vigorous, it may pay to top-graft it with some desirable sort. The branches should be cut back so that they will be about one and one half inches in diameter and two scions inserted in each stub. As a rule it is best to extend the operation over two or three years and thus lessen the check to the tree.

(3.) If the land has not been manured, as will generally be the case, it should receive an application of twenty to thirty loads of decomposed stable manure. The land if in sod should then be plowed, taking care to injure the roots no more than is necessary. For at least two years the land should be cultivated, either with or without hoed crops. Fifty to one hundred bushels of wood ashes per acre can generally be used to advantage.

(4.) If the trunks of the trees are covered with a thick layer of dead bark it will be well to remove it, taking care not to scrape into the living

bark beneath. The trunks should then be washed with soft soap thinned with water to a thick paint. If borers are present a teaspoonful of sulphur and of carbolic acid to a gallon of the soap mixture can be added to advantage.

(5.) Spray the trees with the approved remedies for the insects and fungous diseases that attack the apple. Good results can not be expected unless a perfect and healthy foliage is preserved, and the fruit will be of little value unless it is protected from the ravages of the codlin moth and the apple scab.

The above treatment is of course only suggestive, but, as most orchards will be benefited if handled as recommended, it is submitted for consideration.

INSECTS AND DISEASES.

The more troublesome insects and diseases of this fruit are described in Bulletin 121 and remedies for their destruction are there given.

The following spraying calendar for the apple is here inserted as the other bulletin may not be at hand:

Treatment for Insects and Diseases of the Apple.

(Canker worm, Codlin moth, Bud moth, and Apple scab.)

First application, spray before buds start, using copper sulphate solution.

Second application, after the blossoms have formed, but before they open, spray with Bordeaux mixture and Paris green.

Third application, within a week after blossoms have fallen, use Bordeaux mixture and Paris green.

Fourth application, ten to fourteen days later, repeat.

Fifth application, twelve to twenty days later, spray with Bordeaux mixture.

It may be well to state that the Paris green is for the destruction of any insect, such as the canker worm, codlin moth, or bud moth, that may eat any exposed part of the tree or fruit, while the Bordeaux mixture is only used as a fungicide for the destruction of the apple scab or any of the other fungous diseases to which the trees are subject. The first application is intended to destroy any mycelium of the apple scab that may have wintered over upon the branches. With the second it is intended to coat with a fungicide the foliage and particularly the blossoms and blossom stems, thus rendering them safe from the entrance of the germs of the fungus, while the Paris green is intended to destroy the canker worms that are likely to appear while the trees are in blossom. The third application is to destroy the larvæ of the codlin moth before they enter the fruits and to again provide for the protection of such parts of the tree as are not covered with a fungicide. The fourth application is for a similar purpose, while the fifth is to protect the fruits from the scab.

In many cases and for most varieties, it will not pay, perhaps, to give the five applications, but if canker worms and apple scab are troublesome the second should not be omitted and in nearly all parts of the state the third and fourth applications can be made with profit.

ARSENIC AS A SUBSTITUTE FOR PARIS GREEN.

For the fact that white arsenic is a dangerous thing to have around, from its resemblance to such harmless household chemicals as salt, soda, and baking powders, as well as the trouble required in preparing it for use and the danger of burning the foliage if not properly prepared, we have hesitated about recommending it for general use as an insecticide. During the past two years the price of Paris green has more than doubled, and owing to the ravages of the canker worm the necessity for the use of arsenites has greatly increased, and as a matter of economy to farmers and fruitgrowers we give a method of preparing arsenic for use that will furnish a remedy against chewing insects at less than one fourth the present price of Paris green. As pure Paris green contains only about one half the arsenic found in white arsenic, it will be seen that the latter will go twice as far, and besides it is more likely to be free from adulteration.

To Prepare Arsenic for Spraying.

1 pound of arsenic.
2 pounds of fresh lime.
400 gallons of water.

Boil for twenty minutes in two gallons of water one pound of white arsenic and two pounds of lime that has been carefully slaked. A light, white precipitate will gradually form. White arsenic dissolves slowly even in boiling water, but the lime unites with it as it dissolves and takes it out of solution, so that a small amount of water will answer for the purpose. The white precipitate formed is arsenite of lime, which is the same as London purple without the coloring matter. This is nearly insoluble and, as in the case of London purple and Paris green, the lime used with it prevents injury to the foliage. If desired the water can be poured off and the precipitate can be kept for future use. Before using the arsenic dilute to four hundred gallons. As Paris green now sells for thirty cents per pound at retail while white arsenic can be bought for ten or twelve cents and will go twice as far, it can be seen that it will be much the cheaper to use.

There will be no danger of burning the foliage if the boiling be kept up until all of the arsenic is dissolved and rendered insoluble by the lime, but if this is not done it will be likely to do injury. Until one has had experience in making the solution it will be well to test the material upon a small scale before applying it to the orchard.

The above method of making the arsenite of lime was given in Bulletin 77b of the North Carolina agricultural experiment station.

Dr. Kedzie recommends the following method of preparing it: Boil in one gallon of water one and one half ounces of white arsenic and five ounces of sal-soda. This will quickly dissolve and the fact can be observed, while in the other way it can not readily be determined. Add two pounds of lime and dilute to forty gallons with water.

This amount of lime furnishes a large excess, but will do no harm and may be of advantage.

If the arsenic in any form is to be kept, it will be well to color it with soot, lamp-black, or some other material so that it may not be mistaken for harmless chemicals.

THE PESTS OF THE ORCHARD AND GARDEN.

BY L. R. TAFT AND G. C. DAVIS.

Bulletin No. 121.

Farmers are beginning to appreciate the fact that, if they would raise paying crops of fruit and vegetables, they must protect them from their insect and other parasites. From time to time we have issued short bulletins regarding some of the more injurious forms, both of insects and diseases, but, as the matter is scattered through a dozen or more bulletins and reports, and as our increased knowledge of their life histories enables us to better prescribe for them, this bulletin upon the subject has been prepared.

The portion relating to insects and the remedies for them was written by the consulting entomologist of the station, G. C. Davis, and the diseases, fungicides, and spraying machinery are considered by the horticulturist, L. R. Taft.

In the calendar we have noted some of the most common fruit and garden crops, and the insects and diseases by which they are infested. We have also endeavored to show the remedies that will be found most efficacious against them and the times at which they should be applied. The more important applications and the ones that will be most likely to be needed are printed in italics. The fruitgrower will have to judge for himself, however, as to the number that can be used with profit. In some cases and for some of these crops it will not pay to spray at all, while in others even more applications will be desirable than have been indicated.

In case the material is washed from the plants by rain, it will generally be well to renew the application at once, as it is during wet weather that there is the greatest danger from the entrance of the germs.

FUNGICIDES.

During the past ten years there has been a great increase in the use of various materials for the destruction of the fungous diseases, with which our crops are infested. Previous to 1885, flowers of sulphur was used to some extent for mildew of the grape and the rose, but today the chemicals used in the preparation of funigcides can only be estimated in hundreds of tons.

The material most commonly used is sulphate of copper or "bluestone," which is applied either as a solution in water or ammonia, or combined with other materials. In the case of most of our tree fruits, it has been

found that a strong solution of copper sulphate in water, applied before growth starts in the spring, will destroy the spores and the mycelium of such fungi as have wintered upon the outside of the plants and, by the removal of this source of infection, there will be less danger of the appearance of the disease upon the foliage when it develops. A *weak* solution of the same material late in the season is in some cases desirable. Care should be taken that the dilution is sufficient to prevent injury to the foliage. Upon the naked branches it can be used at the rate of a pound to twenty-five gallons of water, but upon the foliage one pound to two hundred and fifty gallons will be sufficiently strong and, for the peach and other plants with tender foliage, one half that strength, or a pound to five hundred gallons, will be as strong as it will be safe to use. The clear solution has the advantage over most of the other preparations of being cheaper and easier to prepare, and besides it does not spot the foliage and fruit.

As it is used today the Bordeaux mixture is the favorite fungicide, as it is very effective and remains for a considerable length of time upon the foliage, even in seasons of heavy rains. It is a mixture of lime and copper sulphate with water, as a result of which the copper is changed into the form of hydrated oxide of copper. This is insoluble in water, and as applied to the plants it is slowly rendered soluble through the action of the carbonate of ammonia of the air.

If a plant is covered with this material soon after the first leaves appear, any spores of fungi that fall upon it will be destroyed as they germinate.

It will then only become necessary to keep our plants covered at all times to ward off all danger of attack. While this will be impossible, the nearer we are able to approximate to this condition, the smaller will be the injury.

While the lime aids in holding the fungicide upon the plants, it can not be applied to fruits within three or four weeks of the time of ripening, and the fact that it renders plants unsightly is a serious objection in other cases, so that, for some purposes, the adhesiveness of the material is a decided drawback to its use. Not only does the lime spot the fruit and render it unfit for food, but the presence of the copper and the arsenites which are often used with it may, if excessive amounts are used, make it positively dangerous to health.

For all such cases the weak copper sulphate solution mentioned above, or some of the ammonia solutions, may be substituted. The ammonia solution of copper carbonate has many friends, for use at this time. While less efficient than Bordeaux mixture or the copper sulphate solution in water, it has the advantage over the former of not spotting the foliage. The cost, however, is considerably more than for either of the other preparations. While it can be readily prepared by the dissolving of commercial carbonate of copper in ammonia water, and the dilution with the proper amount of water, the cost of the copper carbonate makes it rather expensive. A method of preparing the carbonate of copper from copper sulphate and carbonate of soda is given under "Formulas," which will be but little more trouble and will reduce the cost nearly one half. As thus prepared, it is the same as what is sometimes called "modified eau celeste."

There are several other materials that are sometimes used as fungicides, but none of them equal in efficiency those named above.

CAUTIONS.

In the use of fungicides and insecticides the following precautions should be observed:

1. Do not mix the copper preparations in iron or tin vessels; always use those of wood, glass, or earthenware. The valves, piston, and cylinder, and preferably all parts of the pump with which the material can come in contact, should be of brass.
2. Do not add Paris green to ammonia-containing solutions; always use lime or Bordeaux mixture, especially upon the peach and other trees with tender foliage.
3. When lime is used, slake it carefully and strain through burlap or some similar material. If this is not done the lumps of lime will be likely to clog the pump or nozzle.
4. Never spray with arsenites when the trees are in blossom, as the bees will be killed. They are necessary to fertilize the flowers.
5. Study carefully the nature of the disease or insect and select the remedy that is most likely to destroy it without injuring the plant.

COMBINED INSECTICIDES AND FUNGICIDES.

The expense of the fungicides has been so reduced that the greatest expense in their use is the cost of application. It so happens that for the chewing insects, which include the greater part of those that injure our crops, the arsenites are used. At the time our trees require treatment for this class of insects, we also need to apply Bordeaux mixture for the fungi that threaten them. Not only is it possible to combine the two preparations, and thus save the cost of making one application, but each will be strengthened by it, as the arsenites can be used stronger without danger of injuring the foliage, when united with the lime of the Bordeaux mixture, while the Paris green is of some value as a fungicide and will make the Bordeaux more effective.

If used with any of the copper solutions it should only be upon plants that are not readily injured, and then only in very small amounts.

The results obtained from the union of kerosene emulsion with Bordeaux mixture and other fungicides are far from satisfactory, but the extent to which this material is used makes it of minor importance.

In the preparation of the combined materials, the same amount of the Paris green should be used, whether alone or combined with the Bordeaux mixture, although a considerably larger quantity could be used in the latter case, without danger of injury to the foliage, should it be deemed necessary.

FUNGICIDE FORMULAS.

BORDEAUX MIXTURE.

Copper sulphate	4 pounds
Fresh lime (unslaked)	3 pounds
Water	40 gallons

Place 6 gallons of water in a tub or barrel and hang in it 4 pounds of pulverized copper sulphate, in a burlap or other coarse sack. Slake the

lime, adding water only as fast as it takes it up, and pour together. Before using dilute to 40 gallons. Enough lime should be added to neutralize the free acid, as, if this is not done, it will injure the foliage. To test this, get five cents' worth of ferro-cyanide of potassium (yellow prussiate of potash) at a drug store, and place in a small bottle of water. Add a few drops of this solution to the Bordeaux mixture, before it is diluted, and, if it turns it brown, the lime is deficient and more lime should be added until the ferro-cyanide has no effect. In order to be sure that a sufficient amount of lime has been used, a small quantity should be added after the test shows a sufficiency. When much Bordeaux mixture is used it is an excellent plan to make up a stock solution, which can be diluted as used, proceeding as follows: Dissolve 40 pounds of copper sulphate in 40 gallons of water, and in a box slake 40 or 50 pounds of lime. These can be kept as long as one desires. When needed, measure out 4 gallons of the copper sulphate solution and add some of the slaked lime until no change in color can be produced by the test given above. The mixture will then be ready for use when diluted. The strength of Bordeaux mixture can be varied to a considerable degree. The above formula is about as strong as we care to use at any time, and, after the second application, it is our custom to reduce it by using 50 and even 60 gallons of water for the four pounds of copper sulphate and three of lime. This can be done, with no apparent loss in the efficacy of the Bordeaux mixture, when the fungi are not particularly troublesome, and when several applications are to be made at frequent intervals. If the lime is fresh and a proper amourt is added after it has been carefully slaked, there is no danger of burning the foliage with Bordeaux mixture. Another desirable feature about this fungicide is that Paris green can be used with it, thus saving one application, and that the lime also neutralizes any free arsenious acid in the Paris green and greatly lessens it caustic effect. For all fungous diseases of plants, such as mildews, rust, rots, and blights, in which either the spores, or the body of the fungus itself, is exposed to its action.

Some recommend the addition of four pounds of molasses to the lime after diluting it with water and before mixing with the copper sulphate. This remains for a long time on the foliage and is considered very effective.

COPPER SULPHATE SOLUTION.

(A)	Copper sulphate	1 pound	8
	Water	25 gallons	

For use before the buds open, the above solution is easy to prepare and to apply. It should not be applied to any plant after the leaves burst, as it will burn the foliage. Its action is equal to Bordeaux mixture, but it does not seem as lasting.

WEAK COPPER SULPHATE SOLUTIONS.

(B)	Copper sulphate	1 pound
	Water	250 gallons
(C)	Copper sulphate	1 pound
	Water	500 gallons

We have been much pleased with the results obtained from the above weak solutions. Formula (B) can be used without danger of injuring the foliage upon all except the most tender plants, but for use upon the peach and other tender plants we prefer to rely upon the still weaker solution as given in formula (C).

AMMONIACAL COPPER CARBONATE.

Copper carbonate	1 ounce
Ammonia	enough to dissolve the copper
Water	12 gallons

Dissolve the copper carbonate in the ammonia and dilute before using. The undiluted solution can be kept in glass-stoppered bottles for some time. The strength of ammonia water generally found at drug stores is 20° Baumé. This will answer as well as the 22° or 26° which are generally recommended, but more of it will be required to dissolve the copper, about one pint being necessary for each ounce of the carbonate.

From the fact that copper carbonate as sold on the market is rather costly, it will be better to manufacture it, if much is to be used. For this take

Copper sulphate	2 pounds
Soda carbonate (sal-soda)	2½ pounds

Dissolve these separately in about two gallons of water, pour together, and stir thoroughly. A precipitate of copper carbonate will form and sulphate of soda will remain in solution. The water can be poured off and the precipitate dried and kept indefinitely. From the above quantity of copper sulphate and soda carbonate about one pound of dried carbonate of copper will be obtained. It is often used without drying, however, by adding enough ammonia water to dissolve the copper carbonate and diluting to forty gallons. It is then known as *modified eau celeste.*

POTASSIUM SULPHIDE.

Potassium sulphide (liver of sulphur)	3 ounces
Water	10 gallons

This solution is valuable to use for gooseberry mildew, as it in no way discolors the fruit and is quite harmless.

Like Bordeaux mixture, the last three preparations are for the destruction of fungous diseases, and they should not be relied upon to destroy insects.

INSECTICIDES.

THE ARSENITES—PARIS GREEN AND LONDON PURPLE.

There is little difference in these two insecticides, the former being arsenite of copper and the latter arsenite of lime. The London purple is lighter in weight, mixes more readily with water, and is slightly cheaper, but it burns the foliage more readily than Paris green. Each of them contains a small amount of soluble arsenic.

As a Dust.—The arsenites are often used in the dry form with lime, plaster, or flour. About the best rule that can be given as to the proportion to use is to combine them so that only a very faint green or purple tint will be seen in the mixture. This will make the poison in the proportion of one part to one hundred or one hundred and fifty. Care should be used to distribute it evenly over the plants and not apply too much. Air-slaked lime seems preferable for the diluent, as it will in a large measure prevent burning of the foliage, should too much of the poison be applied. On low plants this method is quicker and easier in making the application than when applied in the liquid form.

Mixed with Bran.—Many insects, when hungry, will eat sweetened bran with avidity. Arsenic is mixed in the bran and dropped in little bunches where wanted. Great numbers of grasshoppers are killed in this way. Success has been reported with climbing cut worms in the same way. Of course one should be careful of stock and chickens at such a time.

As a Spray.—One pound to 200 gallons of water, or 3 ounces to every 40 gallon barrel is not likely to burn the foliage and proves effectual on leaf-eating insects. Occasionally unaccountable injury will occur and it is always safest to use a little milk of lime in the spraying mixture when the Bordeaux mixture (which already has the lime) is not used. A pound or two of the lime, freshly slaked, to each barrel of the mixture is sufficient. It should be considerably diluted and allowed to settle or else strained into the barrel through burlap, or some coarse cloth, before using, or the dirt and impurities will clog the pump and nozzle in spraying. This lime forms a chemical combination with the soluble arsenic and makes it insoluble. In this condition it kills insects as readily as the soluble arsenic, but does not prove harmful to plant life. Even the tender and susceptible foliage of the peach is not damaged when lime is used.

As a Paste with Lime.—This is becoming an important preparation as a means of protection against borers, especially the peach tree borer. Make a whitewash paste of the lime and put in enough of the poison to slightly tint the paste. After removing dead, loose bark, whitewash the trunks of the trees the last of May, and at intervals after that, as needed. It kills the young borer in eating through the outer bark, and one should be sure to apply as low on the trunk as the borers work.

ARSENATE OF LEAD.

This is a preparation of arsenic that is comparatively new in insect warfare. It is a poison like the other preparations of arsenic, though slower in its effect on insects. The important features that commend it are, it is perfectly harmless to the foliage of trees and plants, even when used at the

rate of a pound to a few gallons of water; it will cling to the foliage longer through heavy rains, and it is lighter in weight and will remain more evenly mixed in the water than the other preparations.

Arsenate of lead is not generally found in the drug stores, but the preparation can be made as it is needed. Mr. Fernald gave us the first report of it as an insecticide, and he says:* "A convenient way to prepare this insecticide is to put 11 ounces of acetate of lead and four ounces of arsenate of soda into a hogshead containing 150 gallons of water. These substances quickly dissolve and form arsenate of lead, a fine, white powder which remains in suspension in water.

"It is highly desirable to add two quarts of glucose, or if that can not be obtained, two quarts of molasses, to each 150 gallons of water used, for the purpose of causing the insecticide to adhere to the leaves.

"The experiments with this insecticide both here and in Malden last summer indicate that it will remain on the trees for a long time, even after quite heavy rains."

In Mr. Fernald's experiments, and in other experiments following his, one pound of the arsenate of lead to 150 gallons of water was found to be a mixture too weak and slow to be effective on most insects. Mr. Marlatt found† in his experiments on the elm leaf beetle (*Galeruca xanthomelæna*) that the arsenate of lead gave the best result at the rate of from 50 to 75 gallons of water for each pound. At the above rate this compound of arsenic is more expensive than Paris green or London purple, but for certain insects on plants with tender foliage it is no doubt preferable to the other two.

KEROSENE EMULSION.

This is a common and well-known remedy for soft-bodied insects that do not feed by chewing, but suck the sap instead. The emulsion is cheap, simple, and effectual. It is made of soap, kerosene, and water—three ingredients that the farmer always has at his command.

Soft Soap Formula.—Heat a gallon of soft soap until it becomes liquid, then take from the fire, add two quarts of kerosene and agitate for three or five minutes so thoroughly that the soap and oil will become permanently mixed; that is, until the oil will not separate from the soap either on standing or when diluted. A hand force pump should be used in making the emulsion. Slow pumping or stirring with a stick or spoon will not emulsify the soap and oil.

The emulsion as made is now one third oil and, for the plants, it should be only one fifteenth oil, so it will need four times its own bulk of water before using. In other words, the gallon of soap and two quarts of oil will make seven and one half gallons of the dilute emulsion.

If the emulsion is to be made in the above or greater quantity, it should always be made with soft soap, if that is obtainable, as the emulsion is more difficult to make by the hard soap formula where more water is required.

Hard Soap Formula.—To two quarts of water add one fourth pound of hard soap, heat to the boiling point, and when the soap is dissolved add the pint of kerosene and proceed as in the soft soap formula. This is one

* Bull. No. 24 of the Hatch Experiment Station of Massachusetts, p. 6.
† "Insect Life," Vol. VII, No. 2, p. 123.

fifth oil and should be diluted with twice its own bulk of water before using.

CRUDE CARBOLIC ACID.

Where diluted or emulsified, this preparation has some very good insecticidal properties, and is apparently superior to the kerosene emulsion for certain insects. Always use the *crude* carbolic acid as it is cheaper and quite as effectual as that which is refined.

Carbolic Acid Emulsion.—Mr. Slingerland* has been experimenting quite extensively with this emulsion on the cabbage root maggot, and the formula that he recommends is as follows: "One pound of hard soap or one quart of soft soap dissolved in one gallon of water, into which one pint of *crude* carbolic acid is then poured and the whole mass agitated into an emulsion, which will remain in this condition for a long time. In treating the plants, take one part of this standard emulsion and dilute it with 30 equal parts of water. It can probably be used stronger without injury to the plants. If the emulsion is cold and semi-solid, use several parts of warm water at first."

Carbolic Acid mixed with Soft Soap in the proportion of one part to sixteen of the soap, makes a wash that has been highly recommended for all kinds of borers and for scale insects. The acid may be made into an emulsion and used as a spray if preferred, making the emulsion not weaker than one to ten when diluted.

Mixed with Water, at the rate of a tablespoonful to two gallons of water, and sprinkled over the plants, it has been found to be a temporary repellant for some insects.

Carbolized Lime is a more lasting repellant. It may be made by slaking fresh lime with carbolic acid in the water at the rate of a teacupful of the acid to each bushel of the lime, or by slaking the lime and then adding the acid. The first method mixes it better, but appears to lose part of its strength in the heating. Half a teacupful of the acid is said, by those who have used this preparation extensively, to be sufficient for tender melon vines and a few other tender plants.

WHALE OIL SOAP.

When dissolved in water, this soap makes a very good wash for trees and destroys many soft-bodied insects. It has a strong odor and, with its insecticidal ingredients, is superior to common soap in making emulsions.

PYRETHRUM AND BUHACH.

As these powders are harmless to man and all animals that breathe by means of lungs, they are valuable to us at times when other remedies can not be used. The two substances are made from the flowers of a plant closely related to the chrysanthemum and daisy. The dried flower heads are finely ground and this yellowish powder makes our buhach, pyrethrum, Dalmatine, and Persian insect powder of commerce. There is comparatively little difference between the buhach and pyrethrum, except that they

* Bulletin 78 of the Cornell University Experiment Station, p. 530.

are from two different species of plants, and the buhach is manufactured at Stockton, California, by the Buhach Manufacturing Co., while the pyrethrum is imported from Persia. The powder has a volatile oil that readily escapes on standing, unless confined in nearly air-tight vessels. For this reason the buhach that we can obtain fresh each season is preferable to the imported powder.

As a dry powder is the way the buhach is usually used, and applied by the means of a hand bellows, or else shaken from a piece of muslin. Its effect on insects is still greater when applied in a confined place, as in a tight room or building.

As a decoction in water, it is fully equal, if not superior, to the powder dust. If made in this way, about a tablespoonful should be used to each gallon of water (if hot water can be used all the better), and applied with a spray pump.

BISULPHIDE OF CARBON.

This insecticide, which kills by suffocation, is used by the horticulturist in destroying the pea and bean weevil, ants in their hills, and woodchucks; by those who store grain, for the grain moths and weevils; and by the housewife for the clothes moth, carpet beetle, and similar insects. Last season it was tried by several persons quite extensively on plant lice and similar insects with good success. It seems to be a most promising insecticide in many ways.

Bisulphide of carbon is procured in the liquid form, but upon being exposed a short time to the air it readily changes to a gas and quickly diffuses itself through the air. For this reason it must be confined in a nearly tight jar, box, or building to keep it where it is wanted in treating insects. The liquid comes in tin cans of from one pound to fifty pounds each, according to the amount desired. The best plan is to buy of some wholesale druggist. It is seldom kept by local dealers, and if so it is usually worthless. It is quite inexpensive when bought at wholesale.

For Grain Insects and Pea and Bean Weevil.—There will be no danger to seeds or grain, for food or next year's seed, in pouring the bisulphide over them and confining all in a tight box for several days. The gas is much heavier than air and will quickly settle through the grain and permeate the whole. Even the odor will escape in a few hours on opening the box to the air. *Great care must be observed in keeping all fire and light from the gas, or near where it is confined, as it is very inflammable, and explosive when ignited.*

Enough of the bisulphide of carbon should be used so that the gas will penetrate thoroughly. In large quantities, at least one pound should be used to each twenty cubic feet of space. If the box is not tight, more should be used.

For Ants, make a small hole in the hill, pour in a teacupful of the bisulphide, quickly cover with clay soil and pack it or cover for a few minutes with a wet blanket and then remove the blanket and ignite the gas.

For Woodchucks saturate a ball of cotton with the bisulphide, roll the ball down the hole and close the latter by packing earth over the entrance.

WHITE HELLEBORE.

This is a mild vegetable poison which is sometimes used in the place of the arsenites. It may be used either in the powder, by dusting over the plants, or liquid form, at the rate of a heaping tablespoonful to two gallons of water, and applied as a spray.

TOBACCO DECOCTION.

For some insects a tea made of tobacco, or refuse stems, at the rate of one pound to five or six gallons of water, is highly recommended. Boiling water may be turned over the tobacco, or, better, let it steep a short time and strain when cool.

HOT WATER.

This is a remedy which is simplicity itself and needs no explanation for preparation except that most insects are killed by it at a temperature of 130 to 140 degrees. The foliage of some plants will not endure heat much greater than this, while such plants as the cabbage will endure water raised to 180 degrees without injury. Where insects are working near the surface of the ground, as root lice, or at the base of the trunk, as the peach tree borer, water is often used boiling hot with telling effect on the insect without injury to the tree.

THE DISEASES OF PLANTS.

A plant may be considered in a diseased condition when any of its organs are unable to properly perform their normal functions. This may be brought about by a great variety of causes, many of which are beyond our control, such as extremes of temperature, an excess or a deficiency of moisture, an improper supply of food, either in kind or amount, or, as perhaps is most common, by the work of either insects, fungi, or bacteria.

Much can be done by the grower to give the plants a suitable location, soil, and food, and this will do much to keep the plants in health, but the influences that affect the nutrition of the plants are by no means all of them under control, and the conditions that in one season may give good results may not be present in another.

While plants that are growing in congenial surroundings are less subject to the attack of parasitic fungi than those that are suffering for lack of them, those that are apparently in the best condition to withstand the attack of these parasites do not always escape. It is true, however, that if they are abundantly supplied with food they will suffer less from the attack of the fungus than if the food supply is short.

So far as is now known, most of the parasites that prey upon plants are of a fungous nature. Fungi are a low order of vegetable life and most of them obtain their sustenance from other plants or animals. In case their hosts are living they are said to be *parasites*, but if the food comes from decaying organic matter the name *saprophyte* is applied to them. The former are the ones that cause disease in plants, although the saprophytes may appear in living plants, feeding on the tissues that have been destroyed by the parasitic fungi or in any other way.

SPRAYING

PLANT.	FIRST APPLICATION.	SECOND APPLICATION.
APPLE (*Scab, codlin moth, bud moth, canker worm, tent caterpillar, aphis.*)	*Spray before buds start, using copper sulphate solution. For aphis use kerosene emulsion.*	*After the blossoms have formed, but before they open, Bordeaux and Paris green.*
CABBAGE (*Worms, aphis, flea beetle.*)	*When worms are first seen, Paris Green. For flea beetle, plaster or tobacco dust.*	*If worms reappear, repeat if plants are not heading.*
CHERRY (*Rot, aphis, curculio, slug, leaf blight.*)	*As flower buds appear, but before they open, copper sulphate; for aphis use kerosene emulsion.*	*When fruit has set use Bordeaux and Paris green.**
CURRANT (*Mildew, worms.*)	*As soon as worms are found on lower and inner leaves, Paris green.*	*If they reappear, repeat, adding Bordeaux for mildew and leaf-spot.*
GOOSEBERRY (*Mildew, worms.*)	*As leaves open, Bordeaux and Paris green.*	*In 10 to 14 days repeat with both.*
GRAPE (*Rot, mildews, anthracnose, flea-beetle.*)	*Before buds burst spray with copper sulphate solution.*	*When first leaves are half grown, Bordeaux and Paris green.*
PEACH, APRICOT (*Rot, curculio, leaf curl, mildew.*)	*Before buds swell, copper sulphate solution and Paris green.*	*Before blossoms open, Bordeaux.*
PEAR (*Leaf blight, scab, slug, codlin moth.*)	*As buds start, copper sulphate solution.*	*Just before blossoms open Bordeaux and Paris green.**
PLUM (*Curculio, rot, shot-hole fungus, black-knot.*)	*Cut and burn black knot whenever found. Before buds open spray with copper sulphate solution.*	*As soon as blossoms have fallen, Bordeaux and Paris green.**
POTATO (*Blight, beetles, scab.*)	*Soak seed for scab in corrosive sublimate (2 oz. to 16 gallons of water), for 90 minutes.*	*When beetles or their larvæ appear, Paris green.*
QUINCE (*Leaf and fruit spots, slug.*)	*Before buds open, copper sulphate.*	*When fruit has set, Bordeaux and Paris green.**
RASPBERRY, BLACKBERRY (*Anthracnose, rust, cricket, slug, gall.*)	*Cut out galls, crickets and canes badly diseased with anthracnose. Before buds open spray with copper sulphate solution.*	*When new canes appear, Bordeaux and arsenites.*
STRAWBERRY (*Rust.*)	*Just before the blossoms open, Bordeaux and Paris green.**	*After fruit has set, weak copper sulphate solution.*
TOMATO (*Rot, blight.*)	*If rot or blight appears, Bordeaux.*	*Repeat if disease continues.*

CALENDAR.

THIRD APPLICATION.	FOURTH APPLICATION.	FIFTH APPLICATION.
Within a week after blossoms fall, Bordeaux and Paris green.	*10-14 days later, Bordeaux and Paris green.*	10-14 days later, Bordeaux or weak copper sulphate solution.
After heads form, use hot water or saltpeter (a teaspoonful to gallon of water.)	Repeat, if worms reappear. Use kerosene emulsion for aphis.	
10-14 days later if signs of rot appear, repeat.	10-14 days later, weak copper sulphate solution.	
If worms still trouble, pyrethrum or hellebore.†	After fruit is picked, Bordeaux.	
10-14 days later, sulphide of potass. on English varieties.	10-14 days later, repeat.	If mildew persists after crop is gathered, Bordeaux.
*As soon as fruit has set, repeat.**	*10-14 days later, repeat.*	10-14 days later, if disease is present, apply weak copper sulphate solution.
*As soon as fruit has set, Bordeaux and Paris green.**	*7-12 days later, repeat.*	7-12 days later, repeat.
Within a week after blossoms fall, Bordeaux and Paris green.	*8-12 days later, repeat.*	10-16 days later, weak copper sulphate solution.
10-12 days later, repeat.	*10-20 days later, Bordeaux.*	10-20 days later, weak copper sulphate solution.
Repeat whenever necessary.	When blight of the leaves is accompanied by rot of the tubers, Bordeaux.	Repeat in 10 days, if necessary.
10-12 days later, repeat.	*10-20 days later, Bordeaux.*	10-20 days later, weak copper sulphate solution, if necessary.
10-14 days later, repeat.†	After crop is gathered remove old canes, thin new ones, and spray with Bordeaux if necessary.	(Note—If red rust appears the entire stool affected should be grubbed out and burned.)
As soon as berries are harvested, Bordeaux (if to be kept longer). Repeat, if necessary.	(Note—Young plantations should receive Bordeaux at the time of the 2d and 4th applications to bearing plants.)	(Note—Use kerosene emulsion for aphides whenever present.

* Care must be taken not to apply while the blossoms are open.

The body of a fungus consists of a mass of minute, thread-like tissue, to which the name of *mycelium* has been given. These may be found either upon the exterior of plants, in which case they send short, root-like suckers down into the tissues below and thus take up their food, or they may penetrate the bodies of their hosts, where they suck out the sap from the cells and cause their destruction. While most common on the leaves, all parts of plants are subject to attack. When they have reached a certain stage of development, arrangements are made for reproduction. In most cases, a number of short branches are sent out upon which round or oval spores are formed, the number in most cases being very large. These spores are distributed by the wind, and in various other ways, and if they fall upon a moist place on a plant of the same kind a germinating thread will be sent out and a new mass of mycelium will be formed. In many cases only a few hours will elapse from the time the spore drops from its stalk until it has germinated and become a new fungus. These summer spores can not survive great changes in temperature and moisture and, to carry the fungus over winter, another form known as winter spores is developed by most plants, as the end of the season approaches. These as a rule have thick, firm coverings, and are often buried deep in the tissues of the plants.

When spring approaches, the spores escape from their coverings and the life of the new crop of fungi begins. While in some cases the mycelium survives the winter, there is also, in most cases, a crop of winter spores by which the disease can be distributed in the spring.

While the same conditions do not favor the development of all kinds of fungi, some thriving best when it is hot and dry while with others a cool, moist atmosphere seems most favorable to their development, a certain degree of moisture is necessary for the germination of all forms.

The fungi cause injury to the plants in various ways, as they not only rob the tissues of the food designed for the nourishment of the plant, but, as the cells are ruptured, a large amount of water will be lost by evaporation from the tissues. Oftentimes a large amount of the leaf surface of a plant is involved, and, being unable to perform its normal functions, the assimilating powers of the plant are weakened. When large areas of new stems are involved, the drying out is so deep that the circulation is nearly if not quite cut off and it may result fatally to the plant.

A few of the fungi, such as the powdery mildews, live upon the exterior of plants and can be readily reached by fungicides, but the great majority of them penetrate the epidermis on germinating, and are then beyond the reach of any external application. For all such inside feeders, or *endophytes*, the principal means at hand for combatting them is by the covering of the plants with some material that will destroy the spores and prevent them from sending their germ tubes into the plants. Many forms of fungicides have been tried, but the ones that have been found most efficacious are some of the salts of copper.

In most cases nothing more can be done, but there are some diseases which work in such a way that much can be done to prevent their spread by destroying the infected portions. When this can be done without too great trouble, considerable good will be done.

The bacteria are parasites and saprophytes of an even lower order than the fungi. They are extremely minute, being so small that they can only be seen with the highest powers of the microscope, and consist each of a single cell, although, as they multiply by fission, a single individual sep-

arating into two, they often remain joined together, forming a sort of chain. Under suitable conditions of light and heat, these minute organisms cause rapid fermentation and the decomposition of nitrogenous matter.

A GLIMPSE AT THE TRANSFORMATIONS AND HABITS OF INSECTS.

What is an insect? Most people, were they to reply to this question, would say: An insect is a small creature that can walk and fly and is found everywhere. Ask a student who has studied insects more closely, and he will tell you an insect is a small animal with six legs in the adult stage, which has a distinct head, thorax, and abdomen that are held together merely by muscles. Further, he can tell us that an insect has no bony skeleton like the higher animals, but a horny covering with all the muscles, digestive organs, etc., inside of this shell-like armor. By this definition we have greatly restricted the number of animals in our class of insects; yet, insects proper, if they could be counted, would undoubtedly outnumber all other animal life on the earth, even including man. How essential it is then that we should know more of them and their habits and the best methods for their control, especially when they destroy so many million dollars' worth of property annually.

TRANSFORMATIONS.

In their development, most insects will be found to pass through four different forms—the egg, larva, pupa, and imago.

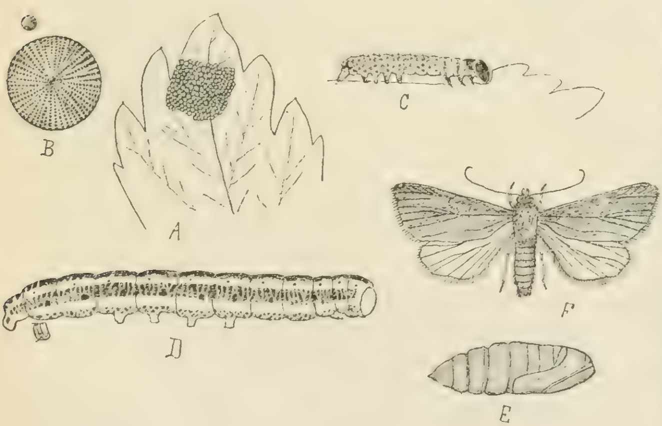


Fig. 1.—*a*, *b*, Eggs; *c*, *d*, Larvæ; *e*, Pupa; *f*, Imago.

The Egg (A and B of Fig. 1).—We are not as likely to find the egg as we are the other three stages, because insect eggs are usually very minute and hard to find. There are some, though, that may easily be seen, as is the case with the slender white eggs of the currant sawfly, which may be found in the spring by examining the central ridge on the under side of the new currant leaves, well in toward the center of the bush. Eggs, when placed in a bunch on leaves or twigs, are more readily seen, and it is a good plan to crush all such egg clusters, as they will usually prove to be the eggs of a pest rather than those of a friend. The egg stage with most insects lasts from a few days to a week or two, though quite a number remain over winter in this stage.

The Larva (plural larvæ). In this immature and growing stage (C and D of Fig. 1) the insect is a voracious feeder. These larvæ are very small when they first hatch from the egg and for some time they are not noticed; but as they grow larger and eat more they are more conspicuous and their injury is proportionally greater.

Larvæ are commonly spoken of as "worms." This should not be, for true worms, such as the angle worm and tape worm, are not insects at all, and we misuse the term. There are names by which different forms of the larval stage are recognized that are perfectly appropriate and proper to use. For instance, we speak of the larvæ of beetles, which work in the ground, as *grubs*; the larvæ that bore in wood, as *borers*; the larvæ of butterflies and moths, as *caterpillars*, and of some moths as *loopers* or *Geometers*; the larvæ of the two-winged flies, as *maggots*, and the larvæ of saw flies, as *slugs*.

The larval period varies greatly with different insects. It is passed by most species in from one to two months in the summer, while others pass through it in a few weeks and still others remain as larvæ over winter, or even for several years (as some of the borers) before passing to the next stage.

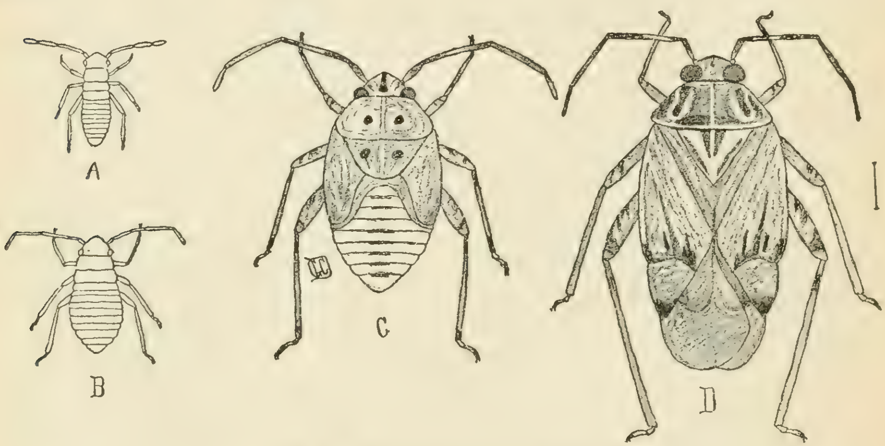


Fig. 2.—Transformation of Plant Bug.

The Pupa (plural pupæ). (See E of Fig. 1). This is known as the *chrysalis* with the butterfly, and with some insects, as the unfledged grasshopper, the *nymph*. It is a condition in which most insects are, to all external appearances, dormant and lifeless, but, inside, there is a great transformation in progress, which will soon change the ugly caterpillar into a beautiful butterfly and the maggot into a fly. Sometimes the larva builds a fine silken cocoon in which to pupate, sometimes it merely draws some leaves around itself and sews them together for the same purpose, though usually it makes a cell in the earth below the surface and transforms in it. The length of time in this stage is quite variable, as they often remain thus a large share of the year, including winter.

The Imago (F of Fig. 1) *or perfect insect.*—This is the stage in which we most often recognize insects. It is short in comparison with the other three stages, lasting only a day or two with some, but long enough to enable them to lay eggs for a succeeding generation or bring forth their young alive. Insects never grow in this stage.

Such is said to be a *complete transformation* (see Fig. 1) or one where each stage is entirely different from the others. Locusts, grasshoppers, and bugs may be said to have an *incomplete transformation* (see Fig. 2), as their different stages of growth are quite similar after leaving the egg. As such an insect grows, it becomes, at times, too large for its skin which then bursts along the back, allowing the insect to crawl out, a new and larger skin growing in its place. With the last moult comes the wings.

HOW INSECTS BREATHE.

Insects do not breathe by means of lungs as do the higher animals. They breathe through minute openings that are scattered in various places over the body. From these openings run minute tubes that carry the air inside to the blood. Not only is their manner of taking air different, but substances that they breathe may affect them readily, while animals with lungs are not affected at all. Thus it is that our pyrethrum and buhach so readily affect insects, while to us it is perfectly harmless. It is not the dust which affects them, but some volatile principle in the oil that probably attacks the nervous system, as it throws insects into spasms as soon as it is breathed. Hellebore will affect insects in the same way, though it is not as likely to be fatal as the others.

DIFFERENT METHODS IN FEEDING.

There are two methods by which insects secure their food, by chewing and by sucking. Those which chew their food masticate it in very much the same way that we do, except that their jaws and other mouth parts move sidewise instead of up and down. To the chewing class belong the greater number of insects. All caterpillars, such as the tent caterpillar, canker worm, peach tree borer, codlin moth, and bud worms; all beetles, as the potato beetle, apple tree borers, grape vine flea beetle, striped cucumber beetle, and plum curculio; all grasshoppers, locusts, and crickets, and many others of less importance, belong to this class. For these insects we apply poisons to the parts of the plant on which they feed and they will soon eat enough of the poison to kill them. Of the poisons taken by eating, the arsenites are the best, if they can be applied without danger to ourselves, because they are the most deadly and certain. Hellebore is also an internal poison, but milder and slower to act than the arsenites.

The second class of insects, those that feed by sucking, are not so numerous, but are more difficult to control. The arsenites have no effect on this class of insects. Let us watch a familiar example, the mosquito, that we may see why the arsenites do not affect it. When the mosquito alights on the hand, it presses its pointed beak close to the skin and then runs down a set of hair-like needles inside of this hollow beak and these pierce the skin. Then, without changing the beak, the blood is drawn through it from the puncture to the stomach. Even if the hand were covered with Paris green, the mosquito would not get a particle of the poison in sucking the blood, as the two are entirely separate. The conditions are the same with a large number of flies, to which order the mosquito belongs, and with the whole order of bugs, such as the brown squash bug, yellow lined currant bug, bed bug, lice on stock, plant lice, and scale lice. The head and beak of a plant bug are shown in the accompanying cut (Fig. 3), with the needle-like parts drawn from the tube.

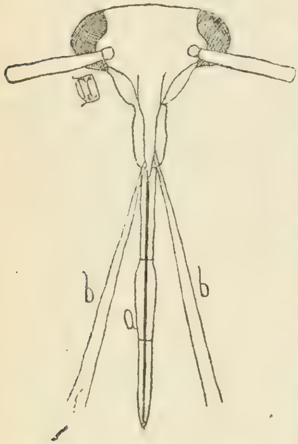


Fig. 3.—Head and Beak of Plant Bug.

We now see why it is that some other insecticide besides the arsenites must be used to kill these insects. They must be killed by bringing some substance in contact with them, and many of our remedies, such as kerosene emulsion, hot water, carbolic acid emulsion, whale oil soap, and pyrethrum are our only means of protection. The kerosene and carbolic emulsions are especially useful as they are very penetrating. All of this last list of remedies must come in direct contact with the insect to affect it, and this is one great reason why these remedies are so often reported a failure.

FUNGOUS DISEASES OF THE APPLE.

APPLE SCAB (*Fusicladium dendriticum.* Fckl.)

This is one of the most destructive diseases of the apple, as it attacks both foliage and fruit, and, although it is more injurious to some varieties and in some seasons, than others, it seldom fails to show itself to some extent. It is generally called "apple-scab," but in some sections it is known as the "black-spot" upon the fruit, and leaf blight and sometimes leaf mildew when upon the foliage.

It generally shows itself first upon the foliage as small, olive green, velvety spots. These enlarge and several may run together and thus involve a large portion of the leaf. Although most common upon the upper surface, they are often found, when the attack is severe, upon the under side, and may even extend to the leaf stem and the young shoots. The tissues attacked are destroyed and soon turn brown and dry up; when upon the leaf the discolored portion drops out, and in severe cases the entire leaf falls.

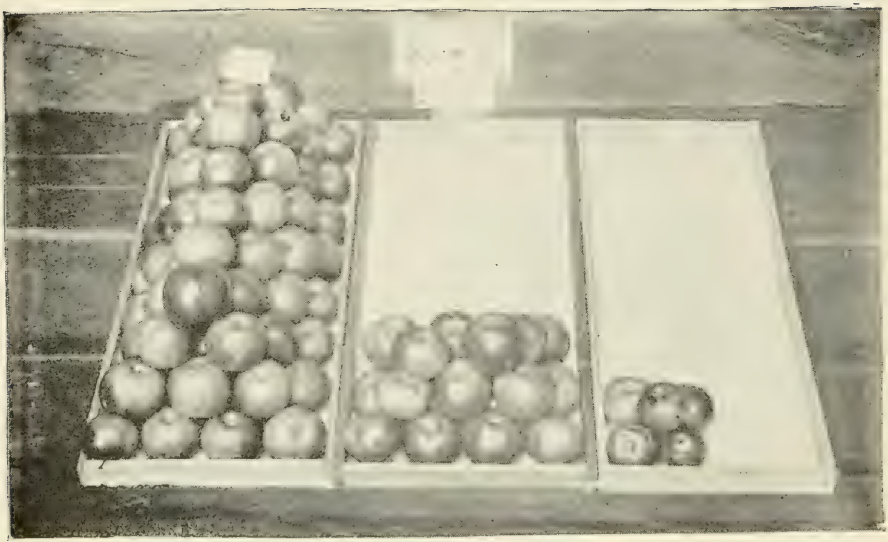


Fig 5. Apples sprayed; 1, 2 and 3 show the grades of fruit obtained.

Fig 6. Apples unsprayed; 1, 2, and 3 show the grades of fruit obtained.

The greatest injury follows when the fungus shows early in the season upon the fruit, especially if the blossom stems are attacked. They are small and delicate, and a very small fungous spot will serve to girdle and destroy them. The spring of 1892 seemed to promise a large crop of apples, as the trees blossomed full, but heavy and continuous rains occurred while the fruit was in blossom, and not only caused an imperfect fertilization of the flowers and a failure to set, but, the conditions being favorable for the development of the apple-scab fungus, most of the others were so badly attacked that they soon dropped, or rotted upon the trees.

FIG. 4.

Fig. 4. Section through a scab spot. *a*, spore (conidium); *b*, hypha or supporting thread; *c*, mycelium, or plant body of fungus; *d*, epidermis of apple; *e*, cells of apple; *f*, spores greatly magnified; *g*, *h*, spores germinating.

When they first appear, the scab spots upon the fruit are about the same as upon the foliage, but, later on, the cells that have been destroyed take on a brownish-white appearance, while a dark-green circle surrounds them in which the fungus is still at work, and from which it constantly extends to the surrounding tissues, checking the growth of the affected parts, and often causing the fruit to crack. During hot, dry summers the fungus seems to rest, but if the season is moist the spread is rapid and the injury is often very great. It is estimated that in some states the loss ranges from one sixth to one fourth of the crop, often reaching a half million dollars.

Not only is the development of the fruit stopped, if it is not prevented altogether, but the injury to the foliage is so great that the tree can neither develop the fruit it does set, nor form fruit buds for the next year's crop. The microscopical structure of this fungus is shown in Fig. 4.

In 1889 careful experiments with various fungicides were made and it was demonstrated that, with a comparatively small expense for labor and materials, nearly *ninety per cent.* of the fruit *would be free from scab,*

while without the use of fungicides the proportion of scabby fruits was nearly as great. Had the spraying been commenced earlier, as we now know to be desirable, even better results would have been obtained.

The experiments conducted in 1893 by Prof. Lodeman of the Cornell experiment station, show conclusively that fungicides can be applied with profit to many varieties for apple-scab.

By the use of Bordeaux mixture and Paris green, the number of first-class apples was more than three times as great as when the trees were unsprayed, while the weight or measure of a given number of fruits showed that the spraying allowed them to attain a much larger size, and thus the total yield was considerably increased.

The illustrations show, in a very satisfactory manner, the results obtained by Prof. Lodeman, Fig. 5 being the relative number of first- second- and third-grade fruits obtained from King trees sprayed six times with Bordeaux mixture, while Fig. 6 shows the number of fruits in the same grades from unsprayed trees.

As a treatment for the apple-scab, we would recommend that the trees be thoroughly sprayed with copper sulphate solution, before the growth starts in the spring. This should be repeated with Bordeaux mixture as soon as the blossoms have fallen. Especially if the season is a wet one, from two to three more applications will be necessary to produce the best results. The addition of Paris green to the second and third applications will hold in check the codlin-moth and canker-worm.

RIPE-ROT OR BITTER-ROT OF THE APPLES (*Glœosporium fructigenum*, Berk.).

The disease which has been commonly spoken of as bitter-rot, from the unpleasant taste it gives the fruit, is also known as ripe-rot. The spots turn brown and, later on, the surface becomes dotted with black pimples. Like other fungi of the same genus, it can be held in check by the use of fungicides. Wherever the disease is troublesome it can only be guarded against by early and repeated applications, as, if the spores once gain entrance to a fruit, the spread of the disease through the tissues can not be prevented. The treatment required for apple-scab will suffice for this disease, and no extra expense will be required.

BLACK-ROT (*Sphœropsis malorum*, Berk.).

While this disease resembles the ripe-rot in some respects, it differs in the fact that it often appears upon partially grown fruit. The spots show as discolored, rotten specks, at any point on the surface of the fruit, but are most common near the stem. While they may be of small size when first seen, they often spread over the whole surface. The part first attacked soon becomes black in color, and minute pustules make their appearance and gradually extend over the diseased portions, rupturing the epidermis in concentric circles. The flesh beneath will be found moderately dry and of a brown color, with streaks or blotches of a darker color scattered through it. The spores are developed within the pustules upon stout stalks and are more broadly oblong in shape and larger than most spores. The mycelium of the fungus spreads through the tissues and destroys them.

So far as is known, there is no remedy that will prevent this disease, but the use of the copper compounds will certainly lessen the injury. The diseased fruit should also be destroyed.

APPLE-RUST (*Gymnosporangium macropus*, Lk.).

This at times proves quite troublesome upon the foliage. It is believed that one stage of this disease is passed in the so-called cedar apples of the red cedar and that the orange-colored spores of that fungus can convey the disease to the foliage of our apple-trees. As a preventive the red cedar trees near apple orchards should be destroyed, if the disease is troublesome.

Although there have been no experiments that prove the fungicides to be effectual against this disease, it is not likely that the spores can gain entrance if the leaves of our apple trees are kept well covered with Bordeaux mixture, as is desirable against the other diseases.

In addition to the above diseases the following are sometimes troublesome:

TWIG BLIGHT (*Bacillus amylovorus*, Burr.), which is similar to the fire blight of the pear, but seldom spreads over the trees; POWDERY MILDEW (*Podosphæra oxycanthæ* (D. C.), De By.), which is most injurious to seedlings in the nursery, but sometimes is troublesome upon orchard trees. It is quite similar in structure to the powdery mildews of the cherry and gooseberry, and the copper compounds will control it; LEAF SPOT (*Phyllosticta pirina*, Sacc.) is also given as injurious to the foliage, and FRUIT SPOT (*Phyllachora pomigena* (Schw.) Sacc.), which has been noted in some sections upon the fruit.

INSECTS OF THE APPLE.

BORERS IN THE TRUNK AND BRANCHES.

There are quite a number of borers that burrow in the trunk and branches of the apple tree. The more common are the ROUND-HEADED BORER (fig. 7) and the FLAT-HEADED BORER (fig. 8). The former is said to live three years in the wood as a grub and to bore in perfectly green wood. Consequently each grub of this species is more destructive than those of the flat headed borer, which are usually more numerous, but live only one year in the tree as a borer and prefer sickly or newly planted trees for their attack The imago of each borer deposits its eggs in June and early July, on, the bark of the trees, usually in crevices or under rough, loose pieces, near the ground, but sometimes on the smooth bark of the limbs.

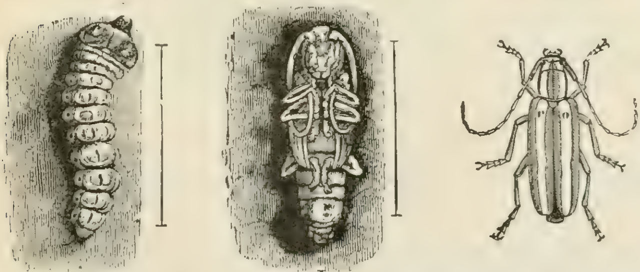


Fig. 8.—Round-headed Apple Tree Borer, *Saperda candida*, *a*, larva; *b*, pupa; *c*, beetle.

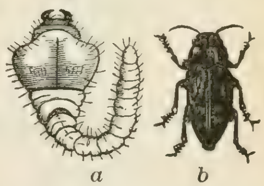


Fig. 7. — Flat-Headed Apple Tree Borer, *Chrysobothris femorata* Fabr. *a*, larva; *b*, beetle.

Remedy.—Borers are a difficult class of insects to deal with, as digging them out after they have entered a tree is a treatment too severe to be practiced if it can be avoided. The best success is found in the use of a repellant, or some form of mechanical coating at the time the eggs are laid. The *carbolic acid and soft soap wash* and *arsenated lime as a paste or whitewash* are the two most likely to give satisfactory results. Whichever is used, the application should be made early in June and a second three weeks or a month later, first clearing off the rough, loose bark.

In applying either of these remedies, a scrub brush does the best work in covering the bark, as it pushes the material into the crevices where the borer usually deposits the eggs.

THE OYSTER-SHELL BARK LOUSE (*Mytilaspis pomorum* Bon.).

Very few orchards in Michigan are free from this pernicious little sap-sucking scale. While it is attached to the bark, all that we see of the louse is the minute scale-like covering which it secretes over itself. Upon lifting the scale, the louse or its eggs can be seen by the aid of a lens. From fifteen to one hundred eggs remain over winter under each scale. In May or early June these eggs hatch into minute yellow lice that soon leave the shell and enjoy a life of freedom for a few days, when they become permanently located, insert their beak for the sap on which they feed, and soon begin to secrete a shell of wax over themselves, never to leave it again. By August the female has filled her shell with eggs, and dies, the eggs remaining in the shell over winter.

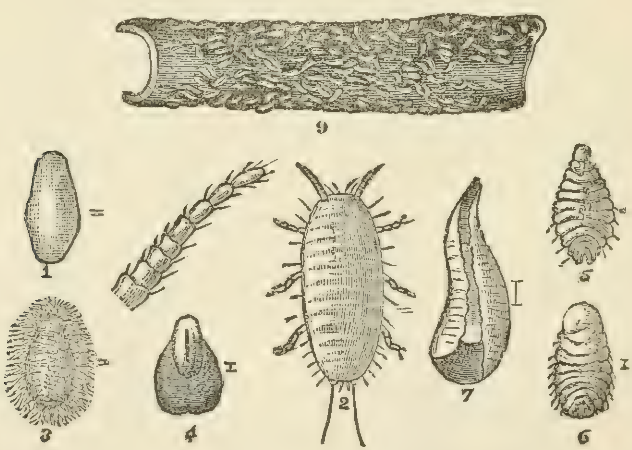


Fig. 9.—Oyster-shell Bark Louse; 2, young louse magnified; 3, secreting wax covering; 5 and 6, louse without scale; 7, louse in scale, underside; 9, scales on bark, natural size.

Remedy.—Scrub the trees with *carbolic acid and soap mixture* in the spring or spray with *kerosene emulsion* in May when the young lice are running.

CANKER WORMS.

Apparently the worst insect of the apple orchards for the past few years has been the canker worm. Many people have found the leaves in the orchard turning brown and disappearing almost as soon as the trees are through blossoming. This is the work of canker worms. If one of the limbs is jarred as soon as the work is noticed, many looping caterpillars, such as are seen in the cut, will often suspend themselves in mid air, or drop to the ground by a thread which they spin. These geometers, or measuring worms, enter life from the egg at the time the leaf is unfolding and develop very rapidly. They eat but little while small, and for this reason their work is not noticed until they are nearly grown, when they are ravenous feeders. They very soon leave the tree and enter the ground to change to a moth that will lay eggs for the next year's generation. Part of these moths appear late in the fall, and lay their eggs, but the greater share of them wait until the following spring. The female is wingless, and must crawl up the tree to deposit her eggs. Many have taken advantage of this peculiarity and placed tarred bands around the trunks, or tin collars, sloping so that she can not crawl over them, and thus prevent egg-laying. Bands of wool, such as are used for climbing cut worms, will probably serve the purpose even better, as they will not mat nor harden with moisture. They should be made tight to the trunks but left loose outside.

Fig. 10 A.—Canker Worm. *a*, male moth; *b*, female moth.

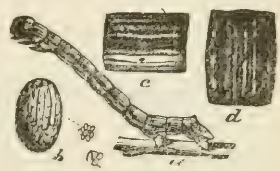


Fig. 10 B.—Canker Worm. *a*, larva, natural size; *b*, eggs, natural size and enlarged.

Remedy.—The means of prevention just given are very good ones, but if the trees are given a thorough spraying with Paris green at the first notice of the canker worms, there need be little trouble in controling them. By a careful search on the young leaves near the ends of the twigs, the small, slender, dark-brown loopers may be found before the trees blossom. They are then young and have done comparatively little harm. This is the time when spraying is a success. Where so many fail with spraying is in waiting too long before applying the remedy. One may be almost certain of finding the canker worms the second year if they have appeared in an orchard.

CLIMBING CUT-WORMS.

In the fruit belt along the shore of lake Michigan and on sandy soil in other parts of the state, climbing cut-worms are frequently the most dreaded of the orchard pests. They appear early in the spring while the leaf buds are opening, and come in such great numbers that, if one is not prepared to stop their work at once, they denude whole orchards in a few days' time. The cut-worms hide in the ground near the surface during the day, and are found in the trees only at night, when they feed. They

climb straight to the top and leave the lower limbs until the last, so that they make the upper part appear dead, while the lower part will be in blossom. Where the buds are eaten, the fruit and much of the foliage is destroyed for the season and sometimes the trees are killed.

There are several species of cut-worm that have this habit of climbing trees and feeding on the buds. A figure of one of these in three of its different stages will give an idea of the appearance of all of them. When a cut-worm is full grown it measures from an inch to an inch and three quarters in length and is very plump. It then ceases feeding, buries itself in the ground, and transforms to a pupa as is shown at Fig. 11, *c*. In this quiet stage it remains until July or August, sometimes until the following spring, when it hatches out into a dingy moth, resembling closely the one shown at *b*. The moth does not eat as the caterpillar did, but merely sups sweets from the flowers at night, resting in some secluded place, as did the cut-worm, by day. At this time the moths mate and the female soon lays a number of eggs, perhaps from 50 to 200, and then, as her mission is done, she soon dies. The eggs are deposited somewhere near the trees, or on the leaves, so that when the young cut-worms hatch in the early spring they will not have to go far to secure a good supply of food. The young cut-worms grow rapidly and soon are matured to again go through the same cycle of life that their ancestors did.

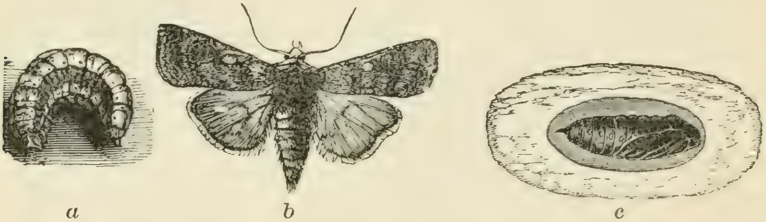


Fig. 11.—Climbing Cut-worm; *a*, larva; *b*, moth; *c*, pupa.

Remedies.—Fruitgrowers in the regions where the climbing cut-worms are most troublesome find good protection in the use of a wool band tied around the trunk of the tree. The band should be four or five feet from the ground and tied in such a manner that it will be tight to the trunk, that the cut-worms can not crawl under, and left loose and fluffy on the outside so that they can not crawl over. It should be placed on the tree early in the spring before the cut-worms make their appearance. Wool will not pack with rain and dew like cotton and similar material.

The only fault found with such a band is that, when the caterpillars can not crawl over the band, they soon become hungry enough to gnaw into the bark beneath the band and so kill or injure the tree. To obviate this Judge Russell of Oceana county has suggested standing small limbs, wet with a strong solution of one of the arsenites, in the ground under the trees close to the trunk. The cut-worms will climb into these limbs in preference to the taller trees and will be killed by the poison. By the use of both bands and poisoned branches one should be able to protect the trees against the worst attacks.

THE TENT CATERPILLAR (*Clisiocampa americana* Harr.).

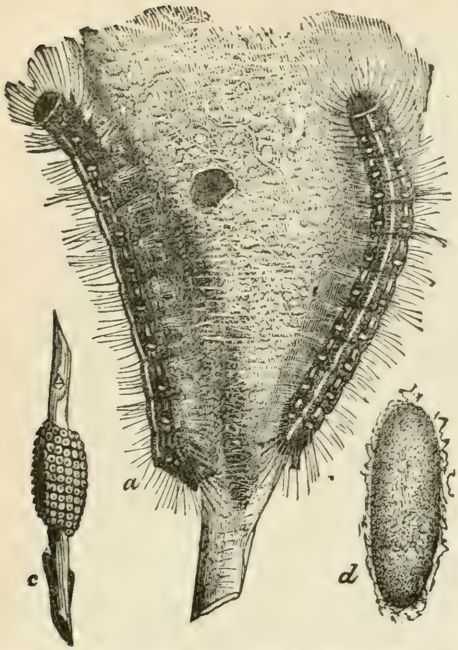


Fig. 12.—Tent Caterpillar; *a* and *b*, caterpillars; *c* and *e*, egg clusters; *d*, cocoon.

The tent in the crotch of some limb, with the caterpillar inhabiting it, is too well known to need much description. The thick, closely woven web, so common in May and June, protects the caterpillars from their foes, except at regular intervals when they leave their tent long enough to feed on the leaves outside, until they reach maturity. If the trees are neglected, large portions are entirely stripped of leaves by these tent dwellers. When about an inch and three fourths long, the caterpillars leave the tent and scatter in all directions for suitable places to transform to the imago, which is a handsome reddish-brown moth (Fig. 13). This moth in early autumn lays a cluster of two hundred or three hundred eggs in a circle around a twig and covers them with a glue-like secretion that protects them until they hatch the following spring.

Fig. 13.—Tent Caterpillar moth.

Remedies.—Cut out and burn in a little kerosene or else crush them while in the tree. They may also be killed with the arsenites if thought best to spray the trees for them. In spraying for the canker worms, the tent caterpillar will be poisoned by the same application. When the egg clusters are found, they should always be destroyed.

BUD MOTHS.

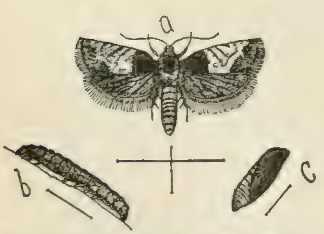
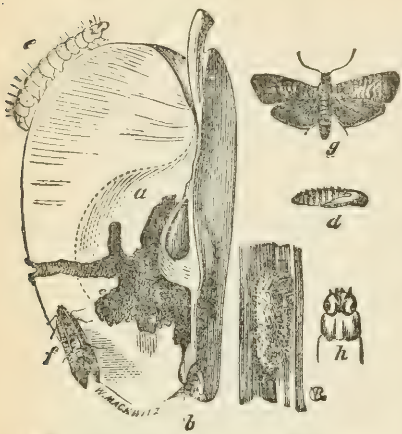


Fig. 14—Apple Tree Bud Moth, *Tmetocera ocellana*; *a*, moth; *b*, larva; *c*, pupa.

Early in the spring minute caterpillars often appear in large numbers to feed on the buds as they are unfolding. One small caterpillar can do a great deal of injury to the leaves at this time, if it does not entirely destroy them while still in the bud. Spraying with the arsenites at the same time that spraying is done for the canker worms and a little before the time of the codlin moth, will be the best protection.

THE CODLIN MOTH OR APPLE WORM (*Carpocapsa pomonella* Linn).



[Fig. 15. Codlin-moth; *c*, larva; *d*, pupa; *i*, cocoon; *g* and *f*, moths.

This caterpillar still remains a common and destructive pest to the apple, though one of the easiest to control by spraying the orchards. As long as spraying is neglected, not much fruit that is marketable or fit to keep can be expected. The accompanying cut explains all the different stages and work of the moth. There are two broods each year, but if the trees are given a good spraying with one of the arsenites within ten days after the blossoms fall from the trees, if there is no rain for a few days severe enough to wash the poison off, it will generally suffice for the season. If the first brood is nearly all killed the second brood will do little harm. If very heavy rains follow almost immediately after the first spraying, a second application, a little later, may be necessary.

THE WHITE TUFTED CATERPILLAR (*Orgia leucostigma*) and THE RED HUMPED CATERPILLAR (*Œdimasia concinna*).

Fig. 16.—Red Humped Caterpillar.

These are so named from the appearance of the respective caterpillars. They are very frequently met with on the apple in numbers that strip the leaves from parts of the orchards and sometimes injure the foliage in whole districts. A good spray of Paris green is the best remedy for them, as well as for a large number of less injurious leaf-eating caterpillars.

APPLE TREE APHIS (*Aphis mali*, Fabr.).

In the spring and early summer these little, green, wingless lice are often found in great numbers over the buds and leaves. Through their minute beaks they take much of the sap that is needed for the life and growth of the tree. They multiply very fast and should be destroyed, if they are numerous, early in the season.

Fig. 17.—Apple Tree Aphis, winged and wingless forms.

After the leaves have developed, the lice will do little harm unless very plentiful. In the fall the winged lice lay their little, black eggs around the buds on the apple twigs. These eggs hatch into the small, green lice when spring opens.

Remedy.—Kerosene emulsion as early as the lice are seen in the spring.

GENERAL CARE OF AN ORCHARD TO PROTECT AGAINST INSECT ATTACKS.

Much that has not been given on the preceding pages can be done in protecting an apple orchard against insect depredations of all kinds. It all comes under good care and management of an orchard.

1. An apple orchard that has had all dead or diseased limbs and trees cut out and burned each season, will seldom be troubled with any kind of borers. Brush piles and dead wood of all kinds in an orchard, breed borers very fast and, as soon as there is no dead wood, they will attack that which is living.

2. Cultivating an orchard will greatly lessen the number of leaf-eating caterpillars and bud moths that annually appear. Many of them pupate in the dead grass and stubble, and when these are not present other insects and birds are quite sure to find them and eat them.

3. If the stock could have all the windfalls and wormy apples each season there would be fewer worm-eaten apples than we now have; and, were orchardists united in doing this, there would be no need of spraying for the codlin moth.

In general we may say, keep the orchard clean and free from dead or diseased wood and rubbish of all kinds. Protect against climbing cut worms by wool bands in early spring. Keep watch when the leaves begin to open, and, if the young canker worms are present, spray the trees with one of the arsenites. In a week or ten days after the blossoms fall, spray the orchard for the codlin moth, and if the wormy apples that may have escaped the spraying are fed to the stock, so much the better. A tree, to be kept in a thrifty condition, should not suffer constant sap drainage from bark and leaf lice and should be protected against them when they are numerous. Occasionally other insect outbreaks may appear in a well-kept orchard, but usually, if we take care of these five or six, the other one hundred and ninety will never cause any anxiety.

DISEASES OF THE PEACH.

PEACH YELLOWS.

Although nothing is known as to the cause of this most-to-be-dreaded disease of the peach, it has been carefully studied for years and the effect of the disease and the treatment are understood by most fruitgrowers. As an indication of the virulence of the disease, it may be stated that, so far as it is known, no tree in the state of Michigan, that has been attacked by yellows, ever recovered from it. The disease has appeared under almost all conditions, and none of them can be cited as the cause. While it is probable that a tree, grown under conditions that are in every way favorable, will be less subject to attack than one that is feeble and exhausted, either from lack of proper food or from overbearing, the tree that is apparently the healthiest may not escape. Excellent illustrations of this disease are shown in Bulletin 103 and in the Report of the State Horticultural Society for 1888.

The disease first shows itself, in bearing trees, in the premature ripening of the fruit; this, with the spotting and streaking of the skin and the flesh of the fruit, is generally a sure sign of yellows. Owing to this spotting, the fruit takes on a high color, and the flesh is also a dark red, although the discoloration may be confined to threads that run from the stone in all directions to the surface.

A tree that has reached this stage should be condemned, and the law requires that fruit with the above described markings shall be destroyed. Although at first the taste is not unpleasant, in the advanced stages it becomes quite bitter.

The second stage of the disease, or the first in trees that are not bearing, is shown by the sending out of small, wiry twigs either from the young shoots or from the axils of the larger branches. The new shoots take on a bushy appearance from the fact that the buds which should send out shoots the following year prematurely develop weak, spindling branches. Not only may these weak shoots from the winter buds appear, but wiry growths may appear at any time and at any place, although they are most likely to start near a crotch.

The leaves will be small and more or less clustered so that they may have a rosette-like appearance; they also generally take on an unhealthy, yellowish look, particularly late in the season and during the following year. Many of the branches will probably die during the second winter and few of the trees will survive the third.

The disease is unquestionably contagious and the only hope of saving an orchard once attacked is in cutting out the diseased trees as soon as the first symptoms are seen. It is not known how early in the development of the disease it takes on its contagious nature, but caution would certainly dictate that they be taken out as soon as the first indication of the disease shows itself, particularly as there is no hope of saving the tree. Many careful observers believe that the disease can be communicated by rubbing a branch of a diseased tree against a healthy one. If this is the case, we can not urge too much caution in the removal of the trees, and many make use of the plan of cutting up the trees and burning them on the spot. It will always be safest to so dig out the trees that the trunk and the larger roots will be removed.

While nothing is known as to the length of time that should elapse before the vacancy can be filled with safety, many peach-growers replant the spring following the taking out of the trees.

The so called "yellows" law is intended to protect fruitgrowers against their careless neighbors who may from ignorance or shiftlessness neglect to remove and burn their diseased trees.

PEACH-LEAF CURL (*Exoascus deformans* [Berk.], Fckl.).

Although the appearance of this disease is familiar to all peach-growers, the nature of the trouble is not generally understood. Sometimes the leaves of the peach, and more often those of the cherry and plum, are infested with plant lice (aphides), and become blistered and curled so that they look much the same as when attacked by the true "curl."

In cases when the attack is a severe one, the foliage may nearly all fall to the ground, and as a result most, if not all, of the fruit drops. Although other leaves will be put out, the check to the tree is a severe one and, in the case of young trees, great harm is often done. Bearing trees may be so

weakened that they may not develop fruit buds for the next year's crop, while those that are formed will be so weak that they are likely to be killed, even in a mild winter. Particularly upon young trees, the disease may also attack the tender shoots and they will be killed back by it.

The "curl" is most troublesome in seasons when the weather, during the two or three weeks following the putting out of the leaves, is cold and wet. After the disease has run its course, and new leaves have come out, there is seldom any further attack, provided the weather comes off warm. The diseased leaves become considerably swollen and blistered and, as it is generally more or less irregular, they are often considerably curled and twisted. The swelling is caused by the working of the mycelium of a fungus within the tissues, and in a few days the upper surface will take on a mealy appearance, owing to the development of the innumerable crop of spores.

The spores remain in the branches and fallen leaves during the remainder of the year and, as soon as the new foliage appears in the spring, are at hand to spread the disease. While the tissues are still soft, they can readily penetrate the epidermis, but it would seem that after they become firm there is no further danger, although any new leaves that appear will be subject to contagion.

To secure good results from any treatment, it is well to head back the branches in the spring, carefully removing any that were injured by the "curl" the previous year, lest the mycelium of the fungus might remain in the tissues and spread to the new leaves when they appear.

Our experience for two years goes to show that, when the trees have been properly pruned and are in good condition, the disease can be held in check if they are sprayed with Bordeaux mixture, making the first application just before the buds open and repeating it as soon as the trees are out of bloom and again at the end of ten days or two weeks.

With each application, Paris green should be used for the curculio. Our own experiments in several places in the state, seem to indicate the value of the above treatment, and the fruitgrowers who have made use of the remedy are well pleased with it, in nearly all cases. It is likely that where failures occurred some of the conditions noted for success were not furnished.

If the disease is in the tissues from the previous year, or if the new leaves were left for a number of days uncovered with the copper compound, the germs could readily enter the tissues of the leaves and no later sprayings would save the leaves attacked, although they would prevent the spread to others.

BROWN ROT (*Oidium fructigena*, Kze. and Schm.).

The peach is also seriously injured by this disease, of which a description will be found under the diseases of the cherry. From the fact that the conditions for the development of the disease are particularly favorable at about the time their fruit begins to ripen, the early varieties seem to be particularly susceptible to the attack of this disease. The germination and work of this fungus are so rapid that frequent applications of fungicides are necessary to hold it in check, especially as the June showers, in which the disease seems to revel, are unfavorable to the highest success, through the washing off of the fungicide.

BROWN SPOT (*Cladosporium carpophilum*, Thüm.).

This often does considerable injury to peaches, particularly to small, seedling varieties. It shows upon the fruit as brown, velvety spots and, if these are very numerous, they will run together and form patches of considerable size. When thus attacked, the fruits fail to reach their normal size and are often rendered of no value for market. While the efficacy of fungicides for this disease is not known, it is believed that they will lessen the injury. At any rate there will be no extra cost for the application, as it will be required for the rot and other diseases. This disease has also been noticed upon Russian apricots, where the injury is even more severe than upon the peach.

Another disease, the exact nature of which has not been ascertained, but which is well described by the common name of "pimples," is also found upon the fruit, particularly of seedlings and the Wager variety. It appears as small swellings, or pustules, and as they are sometimes quite numerous they often seriously injure the appearance of the fruit. The spots are surrounded by a dark purple ring, and the center, particularly of the older spots, is white. This disease does not appear until about the time the fruit ripens, and nothing is certainly known as to the effect of fungicides upon it. It may become a troublesome disease.

The "shot-hole disease" which is described under the plum and cherry, also attacks the leaves of the peach, causing small holes to appear, owing to the destruction and dropping out of the tissues. It seems to be most troublesome on damp soils and in wet seasons, but the treatment recommended for the leaf-curl and the rot seems to lessen the injury.

INSECTS OF THE PEACH.

THE PEACH-TREE BORER (*Sannina exitiosa*, Say).

Fig. 18.—Moths of Peach-Tree Borer: 1, female; 2, male.

Each peach-grower must make the acquaintance of this unmitigated pest very early in his work and devise some means of protection to his trees or the borers will, in a few seasons, assume control. The yellowish white borers, with their black jaws, reddish brown head, and eight pairs of legs are too well known to need further description, but the imagos to which they change (Fig. 18) are rarely seen. The male and female differ somewhat in color and size, but they are both beautiful day-flying moths that are lovers of sunshine and heat. There is but a single brood each season, yet that brood is so irregular that in cutting out the borers there will be a great variety in size, and the moths are present all through the summer, being the most common through July. Soon after appearing, the female begins to deposit eggs, one in a place near the roots, though sometimes higher up on the trunk, even to where the branches start. When the eggs hatch, the young borers gnaw their way through the bark. They then follow the bark closely, cutting long channels as they go, usually toward the roots but sometimes in other

directions. Here they remain until they attain their full growth the following season, when they construct a cocoon of chips in the burrow and transform to a pupa and a little later to the imago.

Remedies.—The exudation of gum from the wound made by the borer in entering is a strong indication of its presence, and borings outside the opening is a sure indication. The general practice is to make use of these signs of the borer and go through the orchard in the fall and spring, and with a knife dig the borers out. While this method prevents the borer from doing its greatest injury to the tree, the cutting-out system has little to recommend it beyond this. Very often the injury made with the knife is as great as that made by the borer and will never heal over. All cutting and boring is more or less injurious to a tree. What we must seek for is some method by which the borer will be prevented from entering the bark, or for preventing the moth from laying her eggs. The best preventive that we can recommend now is a whitewash made of lime to which has been added enough Paris green to give it just a slight greenish tinge. When the young grub hatches and attempts to gnaw through the bark, it will eat enough of the poison to kill it before it enters. The unsatisfactory feature about this method is that the whitewash has to be replenished once or twice through the season, as repeated rains will wash it off. We are just in receipt of a remedy known as "caterpillar lime," that we hope will obviate this difficulty. It comes highly recommended for such purposes by fruitgrowers in Germany, and we shall give it a thorough trial. If it proves as recommended, it will be our best remedy for the peach tree borer. The preparation is sold by Wm. Menzel & Son, 64 Broad-st., New York.

THE PEACH-TWIG MOTH (*Anarsia lineatella*, Zell.).

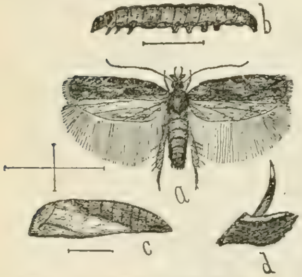


Fig. 19.—Peach-Twig Moth: *a*, moth; *b*, caterpillar; *c*, pupa.

The second most injurious insect, in most peach orchards, is the peach twig moth, *Anarsia lineatella.* The young caterpillar begins feeding at a terminal bud of a peach twig, and after eating the bud bores into the twig along the pith, sometimes to the length of an inch and a half or two inches. Then it will leave that twig and repeat the same process on others until it attains its growth. A few caterpillars will thus destroy quite a number of twigs in a short time, and when the caterpillars are numerous, as they are some seasons, quite a percentage of the twigs will be dead at their tips. The little caterpillars appear very early in the spring, at about the time the buds start, and continue their work for some time after the leaves attain their full size. When full grown the caterpillars are only about one third of an inch long. In color they vary from a reddish to a dusky brown, with the head and thoracic shield varying from yellowish-brown to black. They have eight pairs of legs as represented in *b* of the figure and are naked excepting a few scattering hairs. The caterpillars usually pupate in the dead leaves at the end of the twig on which they worked last, and issue some time in June from the pupa stage as a moth. The second brood of the caterpillars appears in August and, according to Professors Cook and Comstock, specimens of this brood

have been found feeding in the peaches instead of the twigs. Nor does the species confine itself to the peach alone. It has been known to attack the twigs of the plum and, perhaps, the apple in the same way. It has also been reported as a strawberry root and crown borer, destroying many of the plants.

Remedy.—The surest way of disposing of these twig borers is by cutting off the ends of the twigs containing the caterpillars and burning them. The injured shoots can be easily detected by the dead buds and leaves and by exuding gum and similar signs. If the trees are sprayed with one of the arsenites, as the buds are opening, many of the caterpillars will be killed while eating into the twig. The arsenites should never be applied unless lime or Bordeaux mixture is used with them, as the foliage of the peach is tender and liable to injury. With lime, the arsenites are harmless to the foliage.

THE ROSE CHAFER (*Macrodactylus subspinosus*, Fabr.).

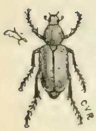


Fig. 20.

In sandy regions and on sand ridges, this beetle is a pest on the rose, grape, peach, apple, and many kindred plants. The beetles appear about the time roses and grapes are in blossom, and none need mistake the awkward, long-legged beetles with a dusty yellow body about one third of an inch long. The chafers breed in the ground, feeding on the roots of various plants, particularly grass, and live in this condition almost the entire period of their life. The imago is above ground only two or three weeks, so it is not the length of time that makes them such dreaded pests, but it is the countless numbers that swarm on the plants and oftentimes fill the air. It is at such times that calls come for help, but with all our remedies we are as helpless as anyone. The arsenites will kill them and so will kerosene emulsion, and hot water at from 130 to 165 degrees Fahr., but none of these are practical where the chafers come in swarms. They are constantly traveling and in a few minutes after treatment with hot water or kerosene emulsion there are as many new arrivals as there were individuals feeding on the plant before. In the peach orchard they appear about the time the peach is a third or half grown. The fruit is the first thing they attack. As it is so fuzzy they eat only a small hole in the skin and then as many as can will enter this hole and eat on the inside of the peach. This habit makes them still more difficult to treat, though for most plants and fruits attacked by them we may say that, where not too numerous, either the hot water or kerosene emulsion when persistently used will prove satisfactory. Beyond this we must look largely to preventive measures, for here is the key to our success. The beetles breed almost exclusively in sandy places, and if we can keep these ridges in our vicinity under cultivation the rose chafer will never appear in numbers great enough to do any serious damage to our crops or fruits.

PLANT LICE ON PEACH TREES.

There are two species of plant lice that work on the peach. The black aphis (*Aphis persicæ-niger* Smith) which lives under ground on the roots and also on the leaves and tender twigs; and the common leaf aphis (*Aphis persicæ* Sulzer), a brownish or yellowish aphis that feeds on the leaves and causes them to curl a little later in the season. There is a plant disease,

known as leaf curl, that produces a similar effect on the leaves. If on examining some curled and knotted leaves, no plant lice are found, one may be quite sure that the formation is not due to the aphids, but to the plant disease. The habits of these lice are the same as those found on the apple, cherry, and plum. They are wingless at first, but, later in the season, both forms will be found. After they hatch from the egg in the spring they produce living young, multiplying very fast, and do a great deal of harm when numerous.

Remedies.—Kerosene emulsion is the best remedy for the lice on they leaves and tender twigs. The remedy should be applied if possible before the leaves curl, as it will be hard to reach them with any remedy when they are protected by the leaf.

The work of the lice on the roots is usually shown in the tree having a sickly and unthrifty appearance, and it is said that one might mistake the appearance for peach yellows. An unhealthy condition of a tree is not necessarily due to the root louse. If the soil is partly dug away from the roots and a few pounds of kainit sprinkled near the roots and the whole covered, the application will benefit the tree. Kainit is a fertilizer and will also kill the subterranean lice if there are any.

DISEASES OF THE PEAR.

PEAR BLIGHT (*Bacillus amylovorus*, Burrill).

The disease of this fruit that is the most to be feared, is the one that is commonly called "fire blight" or "frozen sap blight." It is really caused by the development within the tissues of the germs of a minute bacterium, which produces a sort of fermentation in the sap of the trees. They gain entrance through the nectaries and the stigmas of the flowers, through the soft tissues of the young leaves and stems, and through cracks in the bark. The old name of "frozen sap blight" indicates that fruitgrowers have keen powers of observation, as the freezing and thawing of the unripened wood causes the bark to crack, and the germs are often thus admitted to the tissues of the trunk and older branches. The name of "fire blight" both describes the appearance of the disease and applies well to cases where the bark is cracked by the drying influence of the sun in seasons of drought.

It has been noticed that trees which have grown slowly and have firm, well-ripened shoots are less subject to blight than others that make a watery growth and expose for a long time their soft shoots to the entrance of the germs. Once inside, the germs multiply with great rapidity and spread through the tree, but at a slower rate than is usually supposed. The germs are conveyed from diseased trees to the healthy ones by insects, which visit the flowers for the purpose of obtaining nectar, and the germs then enter through the nectaries or stigmas and such other parts as may favor their entrance. Although we have no direct evidence of the fact, it is evident that they also are carried in the air and thus enter the leaves and the cracks in the bark.

Pear blight causes the leaves to turn a dark brown and may manifest itself suddenly through the entire tree, although as a rule only a single branch is affected at the start, depending upon the way in which the germs have entered.

The fermentation that ensues causes the bark to crack and a thick, gummy sap with a disagreeable odor exudes; the bark soon becomes dry, and if the affection extends entirely around the stem the entire branch soon takes the characteristic appearance of blight. The leaves dry up and remain attached to the stems for a considerable length of time.

If the disease enters through the blossoms, the flowers and fruit spurs are first attacked and turn brown, after which the disease spreads along the branches.

While the germs could undoubtedly be destroyed, if all parts of the trees could at all times be kept covered with Bordeaux mixture, or some other fungicide, this is impossible with the nectaries and to some extent with the young leaves and the cracks in the bark. While the sprayings that should be given the pear trees to destroy the other fungi will aid in holding the blight in check, it will not entirely prevent it.

As a further means of prevention, various precautions can be taken that will do much to lessen the liability of the trees to be attacked by the blight, and among them are the following: 1. Select varieties that have small, firm twigs, and that ripen their growth soon after it forms; 2. while the pear needs a deep, strong soil, care should be taken not to use one that is unduly rich in organic matter, as it would be likely to cause a rank growth that would admit the germs, either through the tissues or the punctures made by the insects, or a late growth that would be injured by the winter; 3. avoid the use of excessive quantities of undecomposed manure, which will also cause a rank growth. The principal dependence should be placed upon mineral manures; 4. in case the trees are making too rapid a growth, the orchard may be seeded down for a year or so.

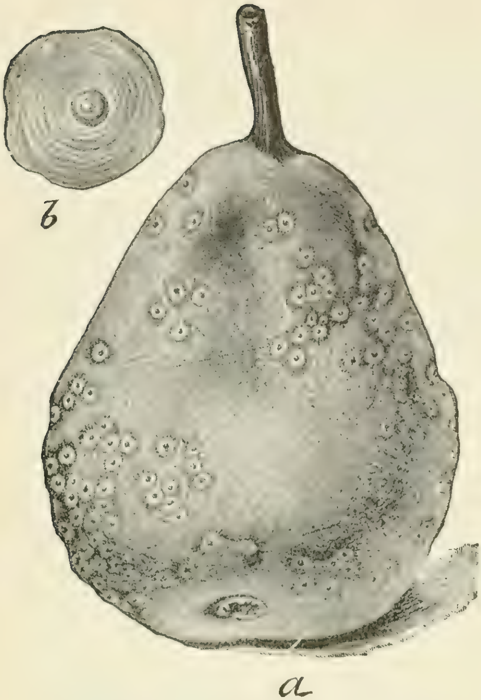
In case the pear blight makes its appearance in a tree, the diseased branch should at once be cut out, making the excision a foot or so below where any signs of the blight appear on the outside, and if the cut surface seems discolored, a cut still lower down should be made. While this may not in all cases prevent the reappearance of the blight, there is nothing else known that will aid in the matter.

PEAR LEAF BLIGHT (*Entomosporium maculatum*, Lev.).

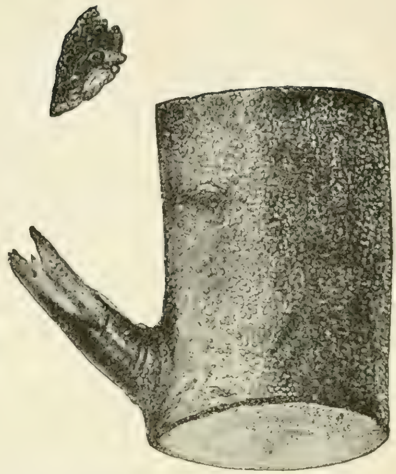
This disease is particularly destructive to seedling trees in the nursery and to those that have borne large crops of fruit in seasons of severe drouth. It is known that it is of fungous origin, and remedies have been found that will hold it in subjection if they do not prevent it altogether.

It first shows itself on the leaves as small, brown spots, which soon coalesce if sufficiently numerous, and thus form spots of considerable extent.

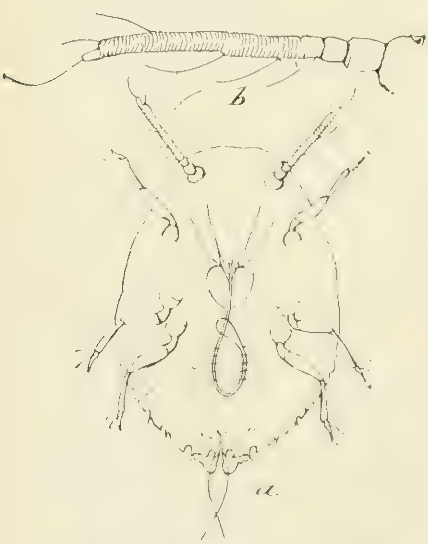
Later in the season, small, black spots appear upon the brown patches, which are composed of great numbers of spores. When the conditions are favorable for the development of the disease, it spreads with great rapidity and so injures the foliage that all of the leaves sometimes fall, leaving the tree, in its denuded condition, unable to ripen its wood. The same disease often appears upon the fruit, where it is known as the "cracking of the pear." If the spots are sufficiently numerous, the growth of the affected parts is checked and a crack is formed. With some varieties the injury is so severe that, before fungicides came into use, it was not possible to obtain marketable specimens from them.



San José Scale.—*a* California pear, moderately infested—natural size; *b* female scale—enlarged.



San José Scale.—Apple branch with scales *in situ*—natural size; enlarged scales above, at left.



San José Scale.—*a* Young larva—greatly enlarged; *b* antennæ of same—still more enlarged.

San José Scale.—*c* Adult female containing young—greatly enlarged; *d* anal fringe of same—still more enlarged.

All illustrations are after Riley and Howard, and used here by permission of the Secretary of Agriculture.

When the disease attacks young pear seedlings in the nursery, it is also very troublesome, as it stops their growth and renders budding uncertain.

It has been found that leaf blight can be readily held in check by the use of the copper compounds, and that if the trees are sprayed with Bordeaux mixture at intervals of about two weeks, up to the middle of August, there will be little if any injury from it.

PEAR SCAB.

The leaves and the fruit of the pear are sometimes attacked by this disease, which is considered identical with that of the apple (*Fusicladium dendriticum*). The principal damage is upon the fruit, and in some cases it is quite severe, but the applications of the fungicides have been found to give fruit nearly or quite free from it.

INSECTS OF THE PEAR.

PEAR TREE SLUG (*Eriocampa cerasi*, Peck).

Fig. 21.—Pear Tree Slug, various sizes.

This is the most common and the worst insect enemy of the pear tree. It is quite as common on the cherry and is often found on quince, plum, and similar trees. The parent fly of the slug is jet black and when seen on a leaf might be taken for a house fly except that it is smaller. It is called a saw fly as the female has a saw at the tip of the abdomen that she uses to puncture the leaf in which to lay an egg. The eggs soon hatch into slimy slugs that eat the tender portion of the leaves and cause them later to appear dead. There are two broods, the first one coming early in June and the second late in July or August. The first brood is the one that does the harm, as the tree needs all its leafy growth in the early part of the season.

Fig 22.—Saw Fly.

Remedies.—Spray with the arsenites or hellebore, or dust the trees with air-slaked lime, plaster, road dust, or ashes. The slugs are very easily killed by any of these and if the first brood is destroyed *there is no danger* of the second.

Many of the insects that attack the apple, plum, and cherry, also work more or less on the pear, such as the oyster-shell bark-louse, the borers, codlin moth, plum curculio, and many of the caterpillars.

THE SAN JOSE SCALE (*Aspidiotus perniciosus*, Comstock).

Ten years ago this pernicious scale was not known east of the Rocky mountains. Since that time colonies have been found in Virginia, Florida, Maryland, New Jersey, Pennsylvania, New York, Canada, Ohio, and Missouri, and no doubt, as the scale becomes better known, colonies will be found in many other localities. Quite likely Michigan may meet with like results, though we know of no colony at present within our borders. We speak of the scale at this time, and furnish illustrations from the Depart-

ment of Agriculture at Washington, D. C., that fruitgrowers may acquaint themselves with this new and one of the worst of all orchard pests, and be on the watch for it, ready to stamp it out on the first appearance.

Apparently, scales were introduced from California in 1886 or 1887 on a lot of Kelsey plum trees imported by New Jersey nurserymen. From these trees the scales spread to the other nursery stock until all the trees were more or less infested by them. By 1889 or 1890 the nurserymen, entirely unaware of the presence of the scale or the mischief it would do, began sending the trees to purchasers, and most of the known colonies are traceable to this New Jersey stock. From these facts we may infer that young trees that have been transplanted six years or less are most likely to have the scale on them, and every orchard and fruit tree that has been transplanted within that time should be carefully examined to see that it has no scale of this kind. Nursery stock should also be carefully inspected for the scale before transplanting; and, could we have state or district quarantine regulations against this and similar nursery importations, we would be far safer than conditions now permit.

San José Scale.—Male adult—greatly enlarged.

The scales will be most commonly found on the bark of the trunk and limbs, though the young travel to the fruit and leaves. When left to themselves for a few seasons they will cover an entire tree so thickly that the bark can rarely be seen, and the tree has an ashy gray appearance and, upon a closer examination, resembles a scurfy deposit. This species of scale can readily be told from the oyster-shell bark louse (see Fig. 9), and in fact from all other scale insects on our deciduous fruit trees, by being circular and with a dark or yellowish dot in the center. The scales are from a twelfth to a sixteenth of an inch in diameter. They are flat, fitting close to the bark, but can easily be scraped off with the finger nail and, when numerous, a yellowish, oily liquid will appear, resulting from

crushing the living, yellowish lice beneath the scales. "During winter the insect is to be found in the half-grown or nearly full-grown condition. The young begin to hatch and to crawl from under the female scales shortly after the trees leaf out, and from this time through the summer there is a constant succession of generations."

The species is known to feed on such trees as the plum, cherry, pear, apple, peach, quince, and rose, and is sure death to a tree within a very few years. Its spread into an orchard and into neighboring orchards is accomplished before people are aware of its presence and then it is very difficult to exterminate.

Remedies.—Mr. J. B. Smith of New Jersey has probably had a wider experience in treating this scale in the east than any other person and the following recommendations are condensed from his own:

1. The treatment should be made in the winter or while the trees are dormant, if possible, as the remedies can be used stronger and made more effectual without injury to the tree at this time.

2. If there is loose bark on the tree, under which the scales can hide, scrape it off. If the trees are large and difficult to reach, prune them back all they will bear and cart the brush away from the orchard.

3. Scrub or spray the tree thoroughly in every part with either a saturated solution of caustic potash or half and half of commercial potash and caustic soda, using about five quarts of water to each pound. This should be applied only when the trees are dormant. At any other time of the year whale oil soap, at the rate of two pounds to each gallon of water, should be used.

4. Follow the first application a month later by an application of kerosene emulsion, nearly full strength, as given by the formulæ under insecticides. The emulsion at this strength will do the dormant trees no harm and ought to kill every scale that escaped the potash solution.

DISEASES OF THE CHERRY.

BROWN ROT (*Oidium fructigena*, Kze. and Schm).

The leaves, flowers, fruits, and sometimes the young stems of the cherry are attacked by this disease. The injury to the leaves or stems is seldom very severe, but, if the flowers or young fruits are attacked, the entire crop may be lost. It is most troublesome when wet weather occurs at, or soon after, the time of flowering. The germinating spores enter the tissues and piercing the cells rob them of their contents. The germs of decay being admitted, the so-called rot ensues. Whenever warm weather follows periods of extended rainfall, we may look for the rot, and if the flowers or small fruits are attacked we may expect that the fruit will be considerably cut short.

The brown rot can be distinguished from ordinary decay by the fact that it produces immense numbers of yellowish-brown spores which appear in large clusters, often covering the fruit or stem. The diseased fruits gradually shrivel and often hang for a long time upon the trees (Fig. 23a).

In combatting this disease, it is particularly desirable that the early spraying with copper sulphate solution should be thorough, that no spores escape to spread the disease to the young leaves and flowers. As the dis-

ease is most likely to be troublesome at the time the early sorts are ripening, care should be taken to keep the fruit and also the leaves well covered with some fungicide, that the spores may be killed as they germinate and thus prevented from entering the tissues. After the fruit is half grown it will be necessary to rely upon some of the soluble fungicides, such as copper sulphate solution (dilute formula), or the ammoniacal solution of copper carbonate.

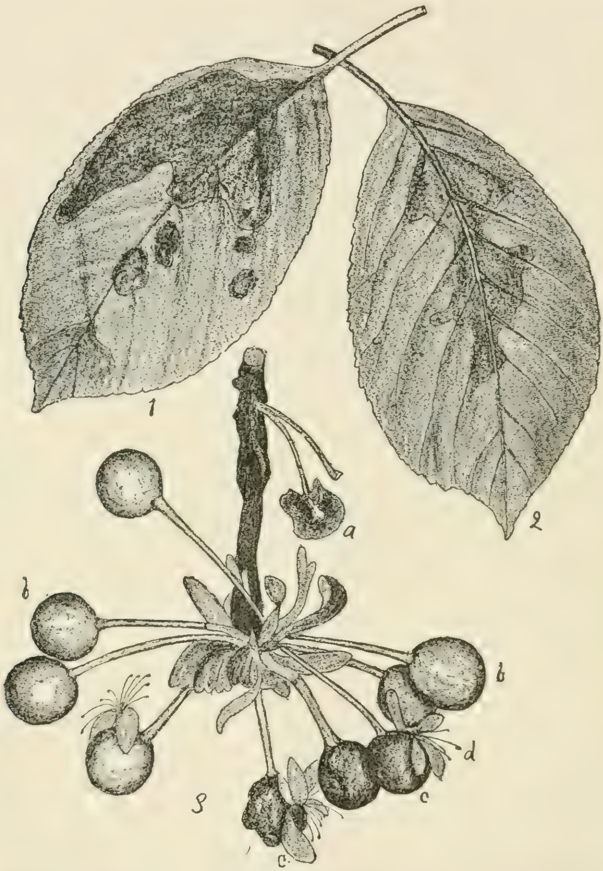


Fig. 23.—Brown Rot of Cherry (*Oidium fructigena*, Kze. and Schm).

1. Diseased leaf showing spots made by fungus, upper side.
2. Ditto, underside.
3. Bunch of cherries attacked by fungus.
   - a. Cherry which was diseased the year before and has hung on the tree over winter.
   - b. b. Green, healthy cherries.
   - c. c. Diseased cherries with the blossom, d, clinging to the fruit.

—*After Galloway.*

POWDERY MILDEW OF THE CHERRY (*Podosphœra oxycantha* (D. C.), De By.).

Like other powdery mildews, this form attacks the leaves and young shoots, often covering them with a fine white powder. It is especially injurious to young cherry trees, but it is also found upon the apple, peach, plum, quince, hawthorn, spiræa, and various other plants of the rose family. It seldom appears before July, and is most injurious in hot, dry summers. The threads of the fungus form a web over the surface of the affected portion, and send up great numbers of fruiting stems, which divide into spores. Later on, the winter spores form upon the mycelium and give the fungus a grayish appearance. Under the microscope the black spores cases are seen to be flattened on one side, and to have long appendages, which bear at their extremities curiously branching tips (Fig. 29, 7). Occurring as it does late in the season, after the growth has been nearly completed, it seldom does much harm but, as it undoubtedly weakens the growth, measures should be taken to keep it in subjection. In most cases, the treatment recommended for brown rot and shot-hole fungus will suffice to hold it in check. It some cases it may be necessary to spray the trees for this disease later in the season than will be necessary for the others.

SHOT-HOLE FUNGUS (*Cylindrosporium padi*, Karst).

This and other closely allied fungi often do great injury to the different species of the cherry. It appears as small, purplish spots upon the leaves. These soon turn yellow and finally brown, and then drop out, leaving small round holes resembling those made by shot. Oftentimes a large number of holes appear in a leaf, and as a result nearly all of the foliage drops from the trees. In this condition the trees are unable to ripen their wood, and, as a result of their unripened condition, are killed, even in a mild winter. It seldom appears until midsummer, but if the season is hot and dry, and particularly if the trees are neglected and uncultivated, it often causes large losses. If a little attention is given to spraying for this disease, after the fruit is gathered, using Bordeaux mixture once or twice, it will do little if any harm.

OTHER DISEASES OF THE CHERRY.

The cherry has a number of other diseases, most of which will be found described under other fruits; among them are black knot (*Plowrightia morbosa*), the scab (*Cladosporium carpophilum*), and rust (*Puccinia pruni*).

INSECTS OF THE CHERRY.

Besides the pear-tree slug, spoken of above, the worst insect upon the leaves of the cherry is

THE BLACK CHERRY-TREE LOUSE (*Myzus cerasi* Fabr.).

Frequently these lice so completely cover, distort, and smear with excrement the cherry leaves that they are disgusting to behold; they not only stop the growth of the tree, but take much of the nourishment that should go to the fruit while maturing. As with all plant lice, they winter in the egg stage, hatching early in the spring into females, which soon commence producing young, and by the time cherries are ripe we have several generations, each individual of which is producing several young each day. About July the lice disappear to the roots or to other plants. In the fall, winged males and females are produced and the females return to the cherry trees, there depositing their eggs around the buds for the next year.

Remedy.—If kerosene emulsion is used on the lice before they roll and knot the leaves around themselves, they can be very easily killed, but when protected by the leaves it is difficult to reach them with any remedy.

PLUM CURCULIO (*Conotrachelus nenuphar* Hbst.).

To the cherries the plum curculio is fully as injurious as to the plums, though the cherries do not drop as the plums do when stung, consequently we do not notice so great damage until we pick a luscious red cherry, apparently sound, and bite into it when we are very likely to meet disappointment. The cherry will grow around and cover up the crescent cut made by the curculio, while the plum will rot from the cut.

Although there is only one brood, the beetles do not all appear at once, and we must fight them (this little, hard-shelled beetle) for several weeks after the blossoms fall, if we save the fruit. If the cherries and plums are a full crop, and the curculio are not too numerous, we can save what the trees will mature by spraying with the arsenites. Spray as soon as the blossoms are all off, and this should be followed by two or three other sprayings at intervals of about ten days. The arsenites should be used with the Bordeaux mixture, as rains will be less likely to wash off the arsenic, and the plant diseases that attack the cherry and plum will be checked by it. If prospects are that this will not save the crop, jarring the trees by means of a padded mallet and collecting the curculio on a sheet should be resorted to. The arsenites are so slow in acting on the curculio that after one has eaten of a poisoned leaf or of the fruit it will still live two or three days, and in the meantime sting quite a number of cherries and plums.

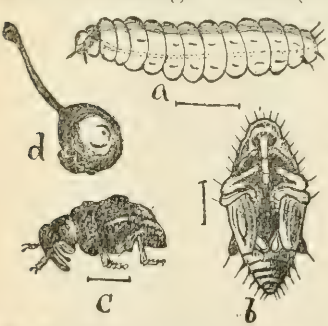


Fig. 24.—Plum Curculio, *a*, larva; *b*, pupa; *c*, beetle.

DISEASES OF THE PLUM.

THE BLACK KNOT (*Plowrightia morbosa*, [Schw.] Sacc).

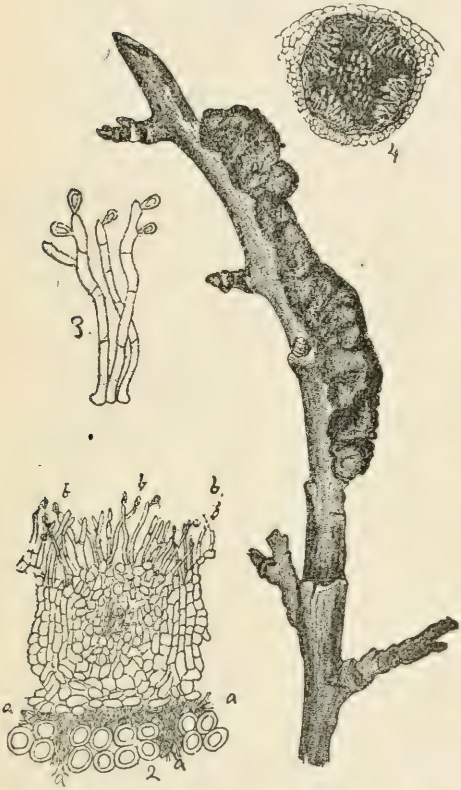


FIG. 25.—BLACK KNOT. *Plowrightia morbosa*, (Schw) Sacc.
1. Stem of plum tree with knot upon it, as it appears in the fall and winter.
2. Perithecium with mycelium, *a a*, between the cells of the stem, and covered with filaments bearing spores, *b*, at their extremities. Section made in May.
3. Filaments and spores (*conidia*), more highly magnified.
4. Section through a cavity containing stylospores. After Farlow.

Although this disease is widely disseminated and has been very destructive to the plum orchards wherever it has appeared, farmers and fruitgrowers, as a rule, do not appreciate the danger of allowing it to get a start in their vicinity. In many sections of New York and New England, and in some portions of Michigan, it has been allowed to get a foothold and within two years the otherwise best cared for and profitable orchards have been entirely destroyed. With these terrible examples before us, every fruitgrower should watch his trees and endeavor to save them from the scourge.

The larvæ of various insects are often found in the knots, and it has been claimed that they are the cause of the knots; but very often knots are found that do not contain insects and, moreover, the microscope and even the unaided eye shows that it is of a fungous nature.

The swellings (Fig. 25) are generally found upon the shoots of the previous year's growth, but may appear upon the larger branches or the trunk. The spores enter the tissues and the threads of the fungus and the cellular growth of the stem, due to the disturbance produced by the development of the fungus, cause the swelling, which often becomes several times the size of the branch. As it grows, the bark cracks and the spongy tissues below appear. The swellings begin to show during the month of May, and early in June will be found covered with an olive-green mould, which consists of the fruiting threads of the fungus, bearing at their tips the minute spores. These are borne about by the wind and in various other ways scatter the disease.

Later on, the surface of the knots becomes hard and black, and a careful examination will show it to be covered with minute pimples. These are the pustules which contain the winter spores of the fungus, which ripen during the winter and serve as an additional means of scattering the

disease. Each of the pimples contains a large number of spore cases or asci, in each of which about eight spores are contained.

Any person who has once seen a knot should be able to recognize them, as, not only are they well marked when in their summer and winter fruiting stages, but the appearance of the knots at any time is distinctive. There are several other forms of spores, but the conditions under which they develop is not certainly known.

When a knot has once commenced to form, no treatment with copper compounds can affect it, but it is likely that, if the trees are kept well covered, the spores will not be able to gain entrance.

The only safe thing is to watch the trees and cut off the knots whenever they appear. If they can be taken in hand in the spring, when the swelling first starts, and before the summer spores form, little harm will be done. The trees should be watched carefully during the summer, and should be examined at least once after the leaves have fallen, as the knots can then be more easily seen and, if they are cut off at any time before January, the winter spores will not have developed. In cutting off a branch, care should be taken that it is removed several inches below where the knot shows, in order that all of the mycelium of the fungus may be removed. If this is not done, the knot will be likely to show the coming spring below where the cut was made. Sometimes the knots are upon the trunks or large branches, which can not be taken off without injuring the trees seriously. If such is the case, it will be well to attempt to save the tree or branch, if the knot has not become too old and hard. The swelling should first be pared off and tincture of iodine applied; this will follow the threads of the fungus and destroy them. The wound should then be painted with lead and oil paint, which will both aid in killing the fungus and preventing the drying out of the tissues.

In 1893 a law was enacted in connection with the "yellows" law, which provides for the destruction of the knots, in case the owners refuse to attend to it, under the direction of the commissioners.

The plum-growing industry is becoming of much importance in many portions of the state, but it is likely to be of short duration if the black-knot makes its appearance in the orchards, unless the law is rigidly enforced.

LEAF SPOT (*Cylindrosporium padi*, Karst).

This disease, often spoken of as leaf blight and shot-hole fungus, and which formerly was described as *Septoria cerasina*, has been one of the most troublesome to the grower of the plum as well as of the cherry. It is quite generally distributed and often causes the winter-killing of thousands of trees, which through the loss of their leaves in August are unable to ripen their wood.

It shows first as small, purple spots, upon both sides of the leaves, and in a short time the tissues attacked take on a brown color. These affected spots frequently drop out, leaving small, round holes, whence one of the common names of the disease. With a lens it can be seen that there are one or more black dots on the under surface of the spots. These are the fruiting pustules within which the spores are produced in great numbers. The spores are long and slender and generally contain a number of cells. Each cell of these summer spores is capable of propagating the fungus.

After the spots have turned brown the winter spores are formed, but they do not become fully developed until the following June, when they are found in pustules on the under side of the leaves in elongated asci or spore cases.

When a leaf has many spots upon it they run together and thus destroy a large part of the tissues. As a result, the leaves drop and the fungus has thus not only robbed the tree of much of its nourishment, but it has deprived it of the ability to assimilate and prevented it from ripening its wood. As the fungus works entirely within the tissues, all remedies must be preventive, but the use of fungicides has been found even more efficacious than might be expected, as Bordeaux mixture, applied as recommended for the rot, will keep the trees free from leaf-blight. For the cherry and plum trees that are not in bearing, it should be applied in July, somewhere about the middle of the month and again about the first to the tenth of August. Had this remedy been employed for the past five years, not only would the lives of thousands of plum trees been saved, but the growth of others would have been largely increased.

PLUM POCKETS (*Taphrina pruni*, Fckl.).

The so called "plum bladders" or "pockets" are due to a parasitic fungus. It causes the fruits to enlarge and become hollow, and finally drop to the ground. It is also quite common upon the branches of American varieties of plum, causing swellings to form upon them.

The fungus is carried over winter in the winter spores in the diseased fruits and branches, and these should be collected and burned. The spring application of copper sulphate will also do much to head off the disease, and by the occasional use of Bordeaux mixture during the summer it can be held in check.

Of the other diseases of the plum, brown rot is most troublesome. It has been described at length under the cherry and peach upon which it also appears. The work of the fungicides can be greatly aided if the diseased fruits are collected and burned.

Leaf rust or blight, which sometimes attacks the leaves of the plum and causes them to fall during hot, dry summers, is the same as upon the peach (*Puccinia pruni-spinosæ*). It shows first as small, yellow spots, which soon cause the remainder of the surface to turn yellow and finally brown and they then fall to the ground. The use of fungicides as recommended for leaf-spot will generally be sufficient to hold it in check.

INSECTS OF THE PLUM.

Besides the plum curculio, spoken of under cherry insects, the plum tree suffers considerably from

THE PLUM-TREE APHIS (*Aphis prunifolia* Fitch).

The life history of the plum aphis is similar to that of those on the apple, cherry, and peach which have already been spoken of. When numerous the lice do considerable injury, as they do not confine themselves to the leaves but feed on the tender twigs and stems of the fruit, drawing so much sap

from them that the plums shrivel and drop off for the lack of nourishment. The treatment is the same for the plum aphis as for the other aphidæ—kerosene emulsion.

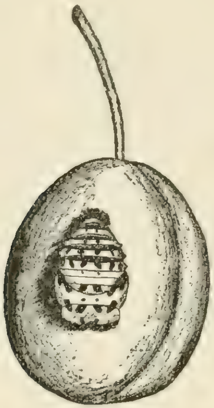


Fig. 26.—Pupa of *Anatis 15-punctata* attached to a plum.

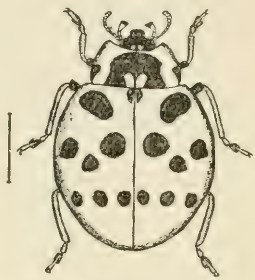


Fig. 27.—Imago of *Anatis 15-punctata*.

Where the aphis has been common on the plum trees, people often find plums with an insect on them resembling Fig. 26 and think it a new pest which has appeared for them to fight. The insect attached to the plum is the pupa of the little lady-bird beetle *Anatis 15-punctata* Oliv. This little lady-bird and the larva from which the pupa came, are insects that feed almost exclusively on plant lice and never injure fruit of any kind. They are friends, as they help rid the trees of the lice, and should never be killed if it can be avoided.

FUNGOUS DISEASES OF THE QUINCE.

While this fruit is attacked in all its parts by fungi, as a rule the diseases have not been very destructive in Michigan and most of them yield readily to fungicides and other treatment.

TWIG BLIGHT (*Bacillus amylovorus*, Burr.).

This disease, which is similar in its nature to the fire blight of the pear, has in some localities made inroads into the quince orchards. As a rule, it is confined to one or more of the branches, but in severe cases it spreads through the trees. It can readily be distinguished from the leaf blight, as it causes the leaves to turn an even brown color and there is no appearance of spots as in that disease. The leaves also remain upon the twigs, which become dry and hard. While Bordeaux mixture will aid in keeping down the disease, it will not entirely prevent it, and the only remedy is to cut out and burn the diseased branches, making the cut several inches below where any sign of disease shows.

LEAF BLIGHT AND FRUIT-SPOT (*Entomosporium maculatum*, Lev.).

Of the other diseases of the quince none is more prevalent than the above, which is of a fungous nature and appears upon the pear in the same forms.

In some seasons, particularly if the trees are grown without cultivation, most of the leaves turn yellow and drop from the trees. As upon the pear leaves, small, circular spots appear, and if numerous enough may run together and cover a considerable portion of the leaves. After a time small black specks appear in the center of the brown spots and indicate that the spores are being formed. This disease yields readily to the Bordeaux mixture, and, if three applications are given, the foliage will keep healthy and will remain much longer on the trees than when the trees are not sprayed, while the fruit will be free from spots. The fact that the trees retain the leaves will cause a marked increase in the size of the fruit, and this will not only give a larger yield, but the fruit will sell for a higher price per bushel.

THE QUINCE RUST (*Roestelia aurantiaca*, Pk.).

The orange rust of the quince attacks both fruit and stems, causing swellings, from which short, horn-like processes protrude, in which the reddish-yellow spores are developed.

If the fruit is attacked while small, it will generally drop, but if it does not come until the fruit has reached some size, and if the spot is small, it will stop the growth of the portion attacked and cause the fruit to become misshapen.

The rust of the quince is one of the forms of the cedar apple, which is often found in the spring on the branches of the red cedar. As a preventive it will be well to destroy all red cedars that are near fruit plantations, especially if "cedar apples" are found upon them. Whenever the swellings are found upon the branches of the quince trees, or when they are seen upon the fruit, it will be well to remove and burn them.

If the trees are kept well covered with some fungicidal preparation, the spores will be killed as they germinate, and beyond the destruction of the red cedars this will be the only thing that can be done as a preventive. While it will greatly reduce the injury, if the rust has been troublesome it may not be entirely effectual, and pains should be taken to remove all of the portions that show the rust as soon as it appears.

THE ROTS OF THE QUINCE.

THE RIPE-ROT (*Glœosporium fructigenum*, Berk.). PALE-ROT (*Phoma cydoniæ*, Sacc.), and BLACK-ROT (*Sphæropsis malorum*, Pk.).

The black-rot often appears before the fruit is half grown, and causes the skin to turn brown. Small, dark pimples soon form beneath the skin, through which the greenish-brown spores are protruded. The remedy for this disease is the same as for the rust, spray to destroy the spores as they germinate, and if any of them escape and cause the fruit to rot, destroy the diseased fruit as soon as it is seen.

The pale-rot works much the same as the one just described, but the spots are at first nearly colorless and finally become of a light blue color. The tissues beneath soon become softened and the infected portion wrinkles up. The ripe-rot or bitter-rot is the same as is found upon the apple. The flesh sinks away and the brown depressions are covered with pimples in which pink colored spores are produced. As with the black-rot the

remedy for the last two diseases is to spray, and then see that all diseased fruits are destroyed.

Were a different treatment required for each of the diseases of the quince, one would soon be discouraged, but, as in most other cases, the sprayings recommended for one will suffice for all, and the labor is after all not burdensome.

FUNGOUS DISEASES OF THE GRAPE.

DOWNY MILDEW OF THE GRAPE (*Plasmopara viticola* (B. & C.), Berl. & De Ton.).

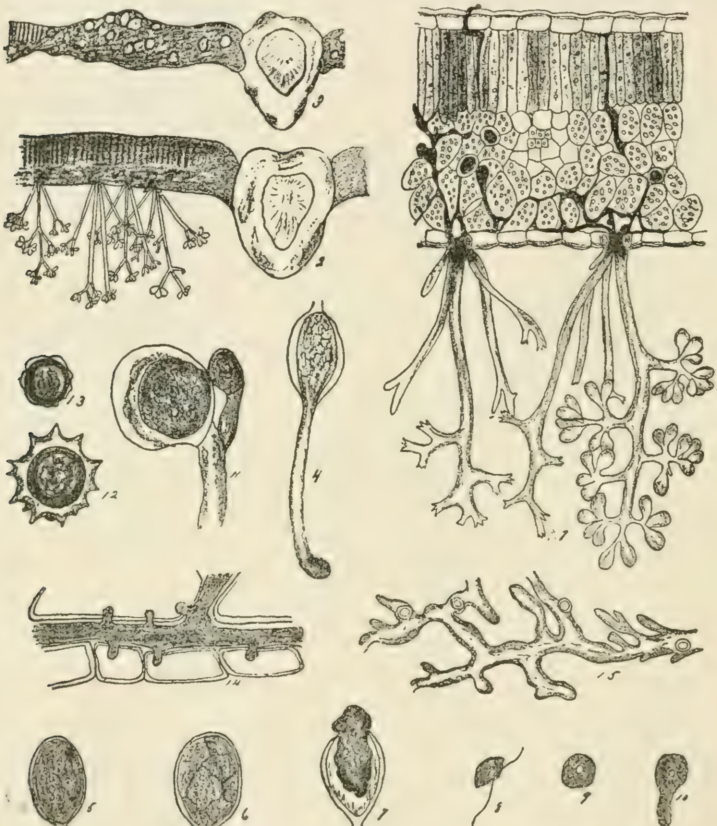


FIG. 28.—DOWNY MILDEW OF THE GRAPE, *Plasmopara viticola.*

1. Section of leaf (greatly magnified) showing conidial stage.
2. Showing the same, less magnified.
3. The same, showing the effect of the fungus, the leaf brown and shriveled.
4. Germinating conidia.

5-8. Development of conidia through zoöspore and swarm-spore stages.

9. Spore.
10. Germinating spore.

11-13. Fertilization of oogonium and development of the oospore.

14. Section of leaf greatly magnified, showing mycelial thread passing *between* the cells, and sending its haustoria into them.
15. Branching mycelium, the spots representing haustoria. —*After Viala.*

This important fruit seems to be particularly subject to the attack of various fungous diseases and all parts of the plant, including stems, leaves, and fruit, are often so seriously injured that the crop of fruit, is lost and the strength of the plant greatly impaired.

It is all the worse because they come at various times and under different conditions. Thus the downy mildew is favored by cold, wet weather, while the so-called powdery mildew luxuriates when it is hot and dry.

This disease, which is sometimes called the American vine disease, is often quite troublesome to the foliage and fruit of our grapes. The spores from which it develops fall upon a leaf and in the presence of moisture quickly germinate. The germinating tube gains entrance through the breathing pores to the interior of the leaves and, passing between the cells of which they are composed, sends its root-like haustoria through the cell-walls (Fig. 28, *14*) and absorbs the cell contents, to be used in its own development. This destruction of the cells causes brown or yellow spots to appear, after which the leaves turn yellow and finally brown, and this is the first indication that will be noticed of the presence of the disease.

If the conditions are favorable, the stalks upon which the spores are developed will push through the stomata on the under side of the leaves and ripen an immense number of oval, colorless, summer spores or conidia. (Fig. 28, *1* and *2*). The stalks and the spores together show as downy or frosty patches, generally on the under side of the leaves, although they may, if the attack is a severe one, appear on the upper side as well as on the leaf petioles and young branches.

The growth of the fungus and the development of the spores are well illustrated in Fig. 28. The leaf soon shrivels as seen at Fig. 28, *3*, and, later on, the thick-walled winter cells form within the leaves. Within them they fall to the ground and are ready to spread the disease the following year. While this disease may attack almost any variety, it is most likely to appear upon such kinds as are naturally weak, or that have become so through soil exhaustion, from over-bearing, or from the attacks of insects or fungi.

The fungus checks the growth of the berries and causes them to turn brown, so that the disease has often been termed brown-rot. When the spores are developed upon the berries it gives them a grayish, mealy appearance. The disease is particularly troublesome in cold, wet seasons when the plants have been weakened by the unfavorable conditions under which they have been growing.

As in nearly all other cases, a fungicide, to be efficient against this disease, should be applied before the spores have germinated upon the plants. This will necessitate an application early in the spring before the buds have swollen, for which spraying copper sulphate solution can be used, and it should be applied thoroughly to all parts of the vines, the trellis, and the soil beneath. In this way great numbers of spores can be destroyed. A second application, using Bordeaux mixture, should be made when the first leaves are about one half grown, and this should be repeated as soon as the fruit has set. The later applications should be made at intervals of from ten to fifteen days according to the weather and the prevalence of the disease. If the summer is cool and wet, as many as five or six applications can be made with profit, and although when the disease is very prevalent the foliage and fruit may not be entirely protected, yet the injury will be very slight, while, were no use of the fungicide whatever made, the entire crop might have been lost.

POWDERY MILDEW OF THE GRAPE (*Uncinula ampelopsidis*).

The so-called powdery mildew is particularly troublesome in seasons when it is hot and dry, and it attacks the foliage and young shoots as well as the fruit. It is particularly troublesome to the varieties that are hybrids of *Vitis vinifera*, the European wine grape. The fungus lives upon the surface of the leaves and obtains its food by sending root-like suckers called haustoria, into the underlying cells, from which they absorb the contents. The summer spores are borne upon simple spore stalks (Fig. 29, *1*) and serve for the rapid reproduction of the fungus. The formation of the winter spores is illustrated in Fig. 29, *4*. The spore cases of the grape powdery mildew can be readily distinguished from others by having the extremities of their appendages arranged in coils.

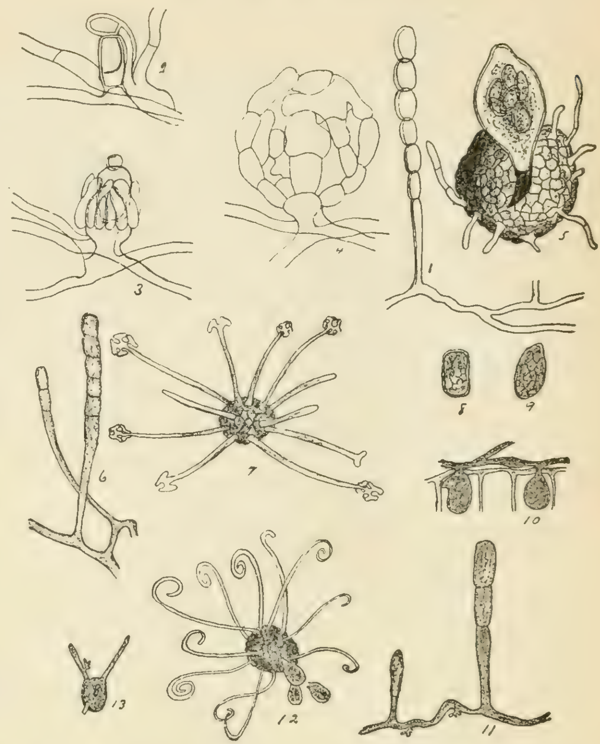


Fig. 29.—Powdery Mildews of Rose, Cherry, and Grape. *1*, summer spore of rose mildew; *2-4*, development of carpogonium; *5*, winter spore (*perithecium*) with ascus, containing ascospores escaping; *6*, summer spores of cherry powdery mildews; 7, winter spore of same; *10*, mycelium with haustoria in cells; *11*, *12*, *13*, the same, of the powdery mildew of the grape.—*After De Bary.*

The thick covering of the winter spores (*perithecia*) serves to protect them from extremes of temperature and moisture during the winter.

The affected portions, during the first half of the season, take on a whitish, powdery appearance, which, later on, changes to a light brown, owing to the presence of great numbers of winter spores. As both the spores and the body of the fungus are upon the surface of the leaves, it is easy to destroy them wherever the copper compounds can be brought into contact with them, but, as it often appears inside the fruit clusters, it is difficult to exterminate if it once gets a start. The sprayings with Bordeaux mixture, that are generally applied for the other diseases, will do much to hold it in check, during the early part of the season, but, later on, as the fruit approaches maturity, the weak copper sulphate or the ammoniacal carbonate of copper will be preferable. The application of flowers of sulphur to such varieties as are subject to this disease, at intervals during the season, will also be of value, especially on grapes grown under glass.

In dry seasons the frequent stirring of the soil will aid in keeping the vines healthy, but upon its first appearance, recourse should be had to one of the above fungicides.

THE BLACK-ROT OF THE GRAPE (*Phyllosticta labruscæ*, Thüm.) (*Laestadia Bidwellii*, (Ell). Via. and Rav.)

In some seasons this disease has played havoc in the vineyards in the southern part of the state, practically ruining the crops. The brown spot disease of the foliage is the same as causes the rot upon the fruit, and, in fact, it generally manifests itself there first. Upon the fruit it shows as small, brown spots, which gradually enlarge until the entire berry has a rotten appearance. Up to this time they generally retain their spherical form, but the point first attacked soon begins to shrivel and finally the berry dries away, until it consists of the seeds, covered by the dried pulp and skin, the latter in folds and furrows that are always distinctive of the disease. In the meantime small black pimples have appeared upon the berries. These are the perithecia in which the winter spores are developed.

The fungus also has other reproductive bodies that are developed in great numbers, especially if the weather is warm and moist, and as the same conditions favor the rapid germination and development of the fungus, the injury from the disease is greatly increased when these conditions are present.

Experiments have demonstrated that in sections where this disease is troublesome it can be held in check by the judicious use of copper compounds. If the vines are thoroughly sprayed in the spring before the growth starts, with a strong solution of copper sulphate, and at intervals of two or three weeks, using Bordeaux mixture up to the time the grapes are half grown, and after that a weak solution of copper sulphate or ammoniacal copper carbonate, there will be but little if any loss from this disease, and other fungous diseases will be held in subjection by the same applications. As a rule no application need be made later than the first of August.

ANTHRACNOSE (*Spaceloma ampelinum*, De By).

This disease is a comparatively new one in this locality and, so far as is known, has appeared in but a few sections in Michigan, and there has done but little harm, as it seems to confine itself to a few varieties, particularly Champion and Vergennes.

It attacks all new parts of the plants and may appear at any time during the growing season. Upon the leaves, it appears as sunken, brown spots with slightly raised rims. The spots generally become elongated and the dead tissues take on a white color. It has a similar appearance upon the stems, but it may extend so deep as to practically girdle the branches and cause the loss of both leaves and fruit. The fruit also is very likely to be attacked, the spots at first showing with reddish-brown borders and gray centers. The berries finally wither and dry up until only the skins and seeds remain, but if the spots are small the portion free from disease may keep on growing and, as a result, the berries will crack and expose the seeds. When they wither in this way, they appear quite unlike those attacked by black-rot, since they do not turn brown as in that disease, nor do they take on the wrinkled and pimply appearance so characteristic of black-rot.

If this disease is allowed to get a start it is generally quite destructive and not only should preventive measures be used, but if it makes its appearance it will generally pay to cut away and burn the infected portions.

The treatment with Bordeaux mixture as recommended in the spraying calendar will do much to hold the disease in check, and if persistently kept up will prevent it from gaining a foot-hold. The treatment should begin early and should be frequently repeated.

SHELLING OF THE GRAPE.

In some seasons numerous complaints are received of the shelling of the grapes from the bunches, the stem breaking short off next to the berry, instead of drawing out from the fruit, as is the case in healthy berries. As a rule, the berries at the lower end of the cluster or at the extremity of the shoulder are the first to shell, and the bunches nearest the extremity of the canes generally suffer most.

The disease does not seem to be of a fungous nature, but, as a rule, it is due to something that has caused a weakness in the plant. This may be due in whole or in part to some fungus that has attacked the foliage and has injured the assimilating powers of the plant. If the fungus has proper treatment there will be no danger of injury from this source. While insects are seldom, if ever, the direct cause of the disease, it is possible that some of them, particularly those that suck the sap from plants, may serve as the inducing cause. In many cases it has been found that the application of mineral fertilizers to vineyards has given crops free from the trouble. This may be attributed to the fact that the soil was deficient in either potash or phosphoric acid, particularly the former, and that they served to give a firm growth and to check the tendency of the plants on soils unduly rich in nitrogenous matter to waste their energies in the production of shoots and leaves, at the expense of the ripening crop. On cold, poorly drained soils, where the plants could not get a proper supply of food, the disease has also been troublesome.

As a rule, there will be little trouble from this disease if the vineyard is on soil of a suitable character, and where the plants receive suitable food and cultivation, avoiding the use of stable manure for the most part and depending for an artificial supply of plant food upon wood ashes, ground bone, and similar mineral fertilizers.

INSECTS OF THE GRAPE.

GRAPEVINE FLEA BEETLE (*Haltica chalybea* Ill.).

The worst enemy to the grape early in the season is this little steel-blue beetle (Fig. 30). Before the buds burst the beetles are gnawing into them and often destroy whole vineyards before it is time for leaves or blossoms to appear. Usually they destroy only a portion of the buds and then feed on the leaves, first as the imago and later as the larvæ from the ggs deposited on the leaves by the parent beetles. The young are dark-brown, hairy, and minute. When full grown they are considerab y less than half an inch long, and are a dirty, light-brown. At this stage they drop to the ground, bury themselves, transform, and, a few days later, appear as a second brood to again feed on the leaves. This brood does little harm compared with that of the first, though they and the larvæ often riddle the leaves with holes and eat all but the arger veins.

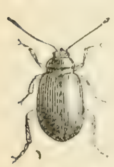


Fig. 30.

Remedies.—The larvæ and beetles feeding on the *leaves* may be readily killed by the arsenites, but this is of little avail where the beetle is at work in the bud where the arsenites will not reach it, and probably the best thing we can do is to jar the beetles off into a broad pan with a little kerosene in the bottom or on a stretched cloth well saturated with the same. The vines are closely pruned and cover but little space at the time the beetles appear, so that the whole vineyard can be quickly gone over in this way. The beetles will readily drop, when the weather is a little cool. As a preventive, keep all rubbish picked up, and fallen leaves raked from the ground so that the hibernating beetles will be without protection. Grape vines growing in grass are much more liable to attack than those that are cultivated.

LEAF HOPPERS.

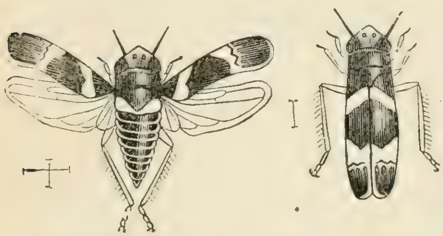


Fig. 31.—Grapevine Leaf Hopper (*Erythroneura vitis* Harr.).

There are several species of leaf hopper that suck the sap from the leaves of the grape until they become speckled, brown, and may even wither and drop off. These leaf hoppers, one of which is shown in the cut, are prettily marked and banded. The most injurious one in Michigan (*Typhlocyba tricincta* Fitch) is nearly pure white with three black bands crossing it. The individuals are about one eighth of an inch long. They work mostly on the under side of the leaves and quickly jump or fly to some other part of the vine when disturbed.

Remedy.—A spray of kerosene emulsion thrown on the under side of the leaves in the cooler part of the day.

The rose chafer is very fond of the blossoms and young fruit of the grape. It has already been treated of under insects attacking the peach.

Climbing cut-worms also attack the fruit and foliage of the grape, but have already been spoken of under the apple insects and the same preventive should apply here.

For the large caterpillars that are occasionally found on the grape vine leaves, it hardly seems necessary to suggest anything more than hand picking, though the arsenites may be used.

DISEASE OF THE STRAWBERRY.

LEAF-BLIGHT (*Sphærella fragariæ*, Sacc.).

In some seasons this disease proves quite destructive both to plants and the crop. It first appears upon the leaves as reddish-purple spots, which soon turn brown and finally white. Upon these spots one form of spore is developed, which is used to spread the disease during the summer, while in the fall and winter a form is produced which in the spring causes the infection of the new leaves as they are developed. Not only does the disease greatly reduce the leaf area of the plants but, by attacking the fruit stalks and the calyx, it tends to deprive the fruit of its nourishment, which results in its shrivelling, and the entire crop may be ruined.

Starting with strong and healthy plants from plantations that have not exhausted themselves by fruiting, and keeping the foliage well covered with Bordeaux mixture, during the first season, there should be little if any signs of the rust at the beginning of the second year. The plants should be thoroughly sprayed with Bordeaux mixture, just as the first blossoms are opening, which will admit of thoroughly coating the flower stalks and the calyxes of the flowers. If the spraying was properly done the first season, no further application will be necessary, but if it was neglected so that it is present to any extent upon the leaves, it will be well to give a second spraying, using copper sulphate solution at the rate of one pound of copper sulphate to two hundred and fifty gallons of water, when the first berries that set are about one half grown.

If the plantation is to be kept another season it should have an application of Bordeaux mixture soon after the fruit has been gathered.

STRAWBERRY INSECTS.

INSECTS OF THE ROOTS.

The fruit and leaves of the strawberry suffer but little from insect attack to what the roots and crown do. The cut-worms that are the farmer's dread at corn planting time are sometimes destructive to the roots and crown of the strawberry by cutting them off in feeding on them.

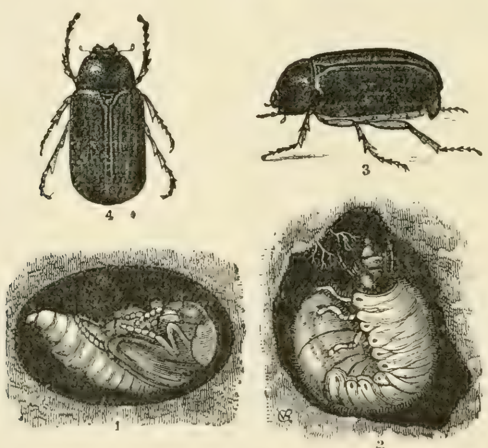


Fig. 32.—*3* and *4*, May Beetle; *2*, larva or white grub; *1*, pupa.

The white grub, or larva of the May beetle, often feeds on the roots and at times becomes quite destructive. One of the worst pests when it does occur is the

STRAWBERRY ROOT BORER (*Anarsia lineatella*).

It is also the second worst enemy to the peach in this state where it is known as the peach-twig moth, because it bores into the twigs and early buds of the peach as they are expanding and kills them. In the strawberry it bores into the crown and down through the heart into the larger roots and usually kills the plant. Closely related to the root borer in work is the strawberry crown borer (*Tyloderma fragariæ*) which, in the grub state, destroys the crown by boring into it.

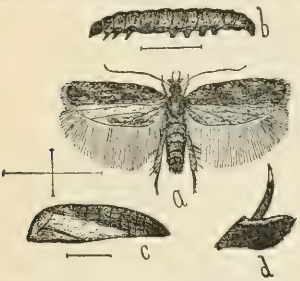


Fig. 83.—Strawberry Root Borer; *a*, moth, *b*, larva; *c*, pupa.

Remedy.—Probably the most satisfactory remedy is a rotation of crops so that the plants will not bear more than two crops of fruit before they are plowed up and a new bed planted in another place. If the insects are known to be at work in the plants at the fruiting season, the plants should be burned before the insects have time to mature and escape.

DISEASES OF THE RASPBERRY AND BLACKBERRY.

ANTHRACNOSE (*Glœosporium venetum*, Speg.).

When the young canes are about one half grown, small purplish spots often appear upon them, and in a short time the centers of these spots become white. If the spots are sufficiently numerous, a considerable area of the canes may be infected and great injury may be done, as not only will the fungus take up the sap of the plant, but, the tissues being broken, there will be a very rapid loss from evaporation, and the spots may dry out to a considerable depth.

The disease may extend to the small branches, fruit stems, and to the leaves. If the area involved is sufficiently large, the entire circulation may be cut off, and the berries and upper portions of the canes will dry up.

In the case of an old plantation, the old canes and those of the new ones that are most infected should be removed as soon as the crop is gathered, or at any rate early in the following spring, and the remaining plants should then have a thorough spraying of copper sulphate solution or of Bordeaux mixture, with later applications the same as for a new plantation.

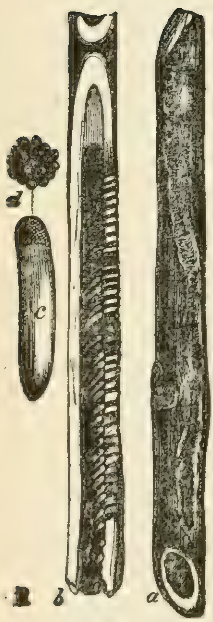
When a new plantation is to be put out the plants should be obtained from a young plantation that is but little if any infected with the disease. In the case of red raspberries and blackberries, it will be desirable to have plants that have been grown from root cuttings. They should be thoroughly sprayed at least three times the first season, and the second season it will be well to spray before the buds start, again as the new canes are a foot or so high, and a third time after the crop has been gathered. For the first and second applications, the copper sulphate solutions can be used, remembering that, after the foliage is out, it is not well to use more than one pound of the copper sulphate for two hundred and fifty gallons of water.

RED RUST (*Cæoma nitens*, Schw.).

Plantations of both blackberries and strawberries, particularly the former, are often greatly injured by this disease. It appears upon the young stems, generally when they are about one half grown, and may extend to the petioles and ribs of the leaves. It lives in the tissues and finally bursts through the epidermis and scatters its numerous orange-colored spores. As a rule, the pustules are considerably elongated, following the furrows in the stems and branches. When the disease appears, the plant should at once be cut out and burned, and if much of the shoot is involved the entire stool should be sacrificed. The neighboring plants, and desirably the entire plantation, should then be sprayed with copper sulphate solution or Bordeaux mixture, to prevent the infection of other plants. In some cases this disease has been very destructive, ruining entire plantations, and every effort should be taken to prevent its spread.

INSECTS OF THE RASPBERRY AND BLACKBERRY.

THE TREE CRICKETS.



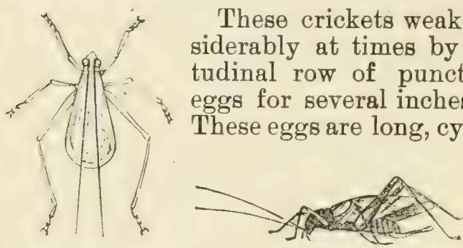


Fig. 34.—Male and female of a Tree Cricket; also canes containing eggs.

These crickets weaken the canes considerably at times by making a longitudinal row of punctures filled with eggs for several inches down the canes. These eggs are long, cylindrical, curving slightly, and look considerably like a grub, for which they are often mistaken. They are laid in the fall and remain through the winter. The young crickets, instead of feeding on the canes in the spring, when they hatch from these eggs, leave the canes and feed on plant lice and succulent green food and fruits. Our most common species is *Œcanthus fasciatus* Fitch.

There is no satisfactory remedy except to cut out and burn the canes containing eggs in the fall or early spring. Clean culture of the berry patch and borders is an excellent preventive. If these two points are observed, no extensive injury need be feared.

RED-NECKED AGRILUS (*Agrilus ruficollis* Fabr.)

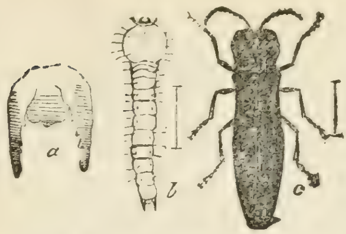


Fig. 35.—Red Necked Agrilus: *b*, larva; *c*, imago.

In pruning the raspberry canes, one will often observe a swelling of the cane for an inch or two. The swelling is apt to be cracked and roughened, manifesting an unhealthy growth. This gall has been termed the raspberry gouty gall. It is produced by a small white grub that works in the cane under the bark. The borer matures in early spring, transforms to a pupa in the pith of the cane, and in June comes forth as a beetle to deposit eggs on other canes for a following generation that will mature the next year. The beetles work more extensively on wild than cultivated raspberries.

Remedy.—Cut out and burn the galls before June.

THE RASPBERRY SAW-FLY (*Monophadnus rubri* Harr.).

For the past year or two, reports have come to us of this saw-fly stripping whole patches of bushes often of several acres in extent. Every year a few are seen on the college patches, but no harm has been done. They are a green, hairy slug working on the under side of the leaf and resembling it so closely that one must look carefully to detect them. They cut irregular holes in the leaf, often nearly perforating it, but when nearly grown and now measuring over half an inch in length, they may often be found feeding on the edge of the leaf. There is but one brood each year, so by the end of June the larvæ leave the bushes and enter the ground where they transform and appear as a four-winged fly the following spring to again lay eggs for another brood.

Remedy.—Spray with hellebore or the arsenites, striking the under side of the leaves as much as possible.

DISEASES OF THE GOOSEBERRY.

THE POWDERY MILDEW (*Sphærotheca Mors-uvæ*, [Schw.] B. and C.)

Although the European varieties are particularly subject to this disease, it frequently appears upon those of American origin. While they grow luxuriantly in England and in many parts of continental Europe, the cool, moist climate being particularly favorable for them, the European gooseberries suffer a serious check in our hot, dry summers and are quite likely to be attacked by powdery mildew, which, as previously stated, like all others of its class, luxuriates in a warm, dry atmosphere.

In a general way, the descriptions that have been given of the other powdery mildews will apply to this one. It appears early in the season upon the young leaves and tender shoots, and has at first a cobwebby appearance, but, when the spores have formed, it has a white, powdery look and later on becomes brownish, owing to the presence of the dark-colored, winter spore coverings. The growth is checked and in severe cases the leaves drop off, leaving the bare stems. The action of the fungus upon the fruit is to check the growth of the portion attacked, and cause it to become misshapen. In many localities it has been useless to attempt the cultivation of the European varieties on account of this disease. Attempts have been made to grow them under conditions similar to those to which they are accustomed, by planting in deep, rich, moist soil, and mulching the plants. Others find them fairly successful on the north side of a fence or building. The use of sulphur was also tried and seemed to have a good effect, but within the past five years a better remedy has been found in liver of sulphur (sulphide of potassium). While Bordeaux mixture is even more effectual and is preferable on account of its sticking qualities for use early in the spring, it is better to use the potassium sulphide or weak copper sulphate solution after the fruit is half grown, as it will not spot the fruit. To keep the European sorts free from mildew, it is well to spray the plants once in from two to four weeks from the time the leaves come out until the middle of August. The longer time will answer if insects or mildew do not appear, but, whenever it manifests its presence, the fungicide should be applied at once, together with Paris green or pyrethrum according to the season, if worms trouble.

While mildew is the most troublesome of the diseases of the gooseberry, it is sometimes seriously injured by several "leaf-spot" diseases, which will be described as affecting the currant, and the rust (*Æcidium Grossulariæ*, Schum.). As a rule, the treatment recommended for mildew will suffice for the others.

DISEASES OF THE CURRANT.

Frequently the foliage drops from currant plants during the summer, owing to the presence of fungi, of which the most comman are the so-called spot diseases (*Septoria ribis* and *Cercospora angulata*, Winter).

These differ but slightly from the other spot diseases and cause small, brown spots to show on the leaves during June and July, and, the tissues being destroyed, the affected portion drops out. In several ways the spots caused by these diseases bear some resemblance to the strawberry leaf-blight and may in time be referred to the same genus.

In sections where this disease is troublesome, the spraying of the plants should not be neglected. By the use of two or three applications the leaves can be retained upon the plants throughout the season.

CURRANT AND GOOSEBERRY INSECTS.

THE CURRANT SAW-FLY (*Nematus ribesii* Scop.).

This imported currant worm has been a pest among us so long and is so well known that it needs no introduction. The imago of this insect is not so well known and a cut of the male and female is given. Two broods of this saw-fly appear each year, but the most destructive one comes early, when the flies will be very noticeable around the bushes in the warmer part of the day. When the leaves are unfolding the little white eggs are

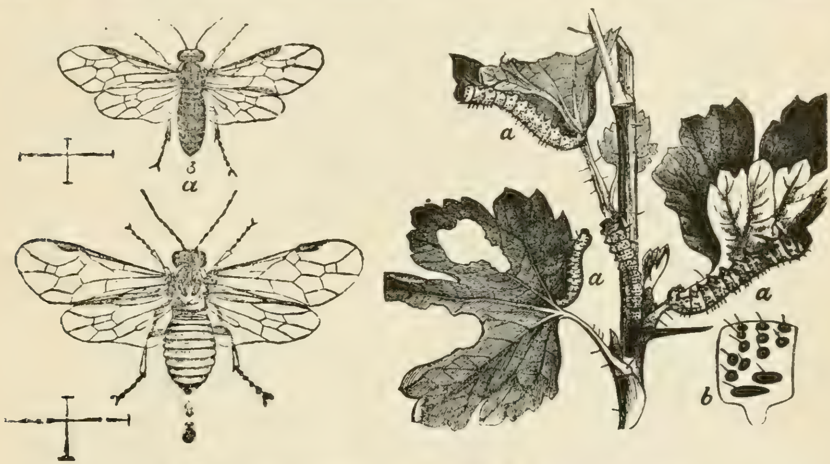


Fig. 36.—Currant Slugs and the Saw-Flies to which they change.

laid along the midrib of the leaves, and from these eggs the young slugs will soon appear. While they are still very young is the time to treat them with a spray of Paris green. If thoroughly treated at this time and heavy rains do not appear too soon, the currant slug will not injure the bushes again through the season. If another spraying is needed when the fruit is nearly ripe, hellebore can then be used. The currant worms hatch first, and are thickest, low down in the center of the bush, and care should be taken to spray thoroughly in that part.

CURRANT BORERS.

There are at least three species of borer that work in the canes of the currant and if not interfered with will ultimately kill the bushes. In early summer the eggs are laid singly near buds, and the young borer works through the bud into the pith of the cane where it feeds until late fall or early spring when it changes to a pupa and later appears as the imago.

Fig. 37.—Imported Currant Borer, *Sesia tipuliformis* Linn., in larva, pupa, and imago stages.

Fig. 38.—American Currant Borer, *Psenocerus supernotatus* Say.

Remedy.—The remedy is the same for all three of the borers. The dead and injured canes can be told as soon as the buds are opening and should at this time be cut out and burned. This will destroy the borer before it can mature and escape.

THE SPAN-WORM (*Eyfitchia ribearia* Fitch).

The span, or looping caterpillar of the currant and gooseberry, when it appears in a locality, is usually quite destructive by very quickly stripping the bushes of their leaves. The cut shows the caterpillar, natural size, in a few of the many attitudes which it assumes, and represents it so well that no description is needed. There is only one brood in a year and this brood often has its numbers greatly reduced by parasites.

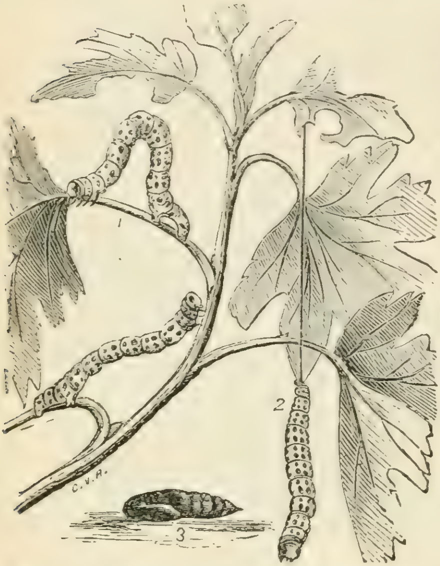


Fig. 39.—Currant Span-Worm; *1* and *2* represent the looping caterpillars; *3*, the pupa.

Fig. 40.—Currant Span-Worm Moth.

The remedy is Paris green when it can be used without poisoning the fruit, otherwise hellebore.

THE YELLOW-LINED CURRANT BUG (*Pœcilocapsus lineatus* Fabr.).

Fig. 41.—Yellow Lined Currant Bug.

The injury done by this bug is in puncturing the young leaves so that little brown blotches appear and later, when these spots become more plentiful, the leaves will wither and drop off. The bug is quick and active and when approached dodges to the other side of the leaf or drops to the ground. The line at the right of the drawing shows the natural size of the bug.

Remedy.—Spray with kerosene emulsion.

INSECTS OF THE CABBAGE.

The cabbage is a great sufferer from insect attacks. From the time the plants are large enough to transplant until they are harvested, they are beset with numerous insect pests. The earliest species to attack cabbages is

THE CABBAGE FLEA BEETLE (*Phyllotreta vittata* Fabr.).

Fig 42.—Cabbage and Turnip Flea Beetle.

Not only young cabbages, but turnips, radishes, tomatoes, and many other plants suffer from the work of this pest. The minute shining black beetles, with two wavy white lines above, are shy and will leap a long distance on being approached. They gnaw little holes in the leaves of the young plants and later the larvæ feed on the roots. There are several broods, but the first one does the harm.

Remedies.—Lime or land plaster dusted over the plants is a very good protection. Tobacco as a dust or a decoction is generally considered more effectual.

THE CABBAGE-ROOT MAGGOT (*Phorbia brassicæ* Bouche).

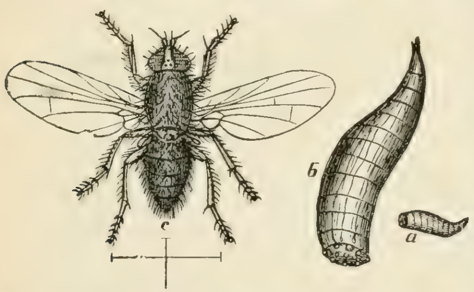


Fig. 43.—Cabbage-Root Maggot, (*a*) maggot natural size, (*b*) magnified; (*c*) imago.

The cabbage-root maggot is a difficult pest to manage, as its work is usually at an end before the cabbage shows any outward signs of its work, and then a remedy comes too late. The roots are so badly eaten and perforated that the cabbage plant soon dies. On pulling the wilted plant, the most of the root will be found to have been eaten and the remainder often in a decaying condition. Occasionally a little white maggot, less than one fifth of an inch long, will be found in digging up an affected plant. Usually by the time a plant has reached this stage, the maggots have burrowed a short distance away from the root and will be found as pupæ resembling, somewhat, a little oblong brown seed. The paupa later changes to a fly that is much like our common house-fly. The first brood of maggots, that attack the cabbage roots in the latter part of May or early in June, is the most destructive one, but young cabbages put out in early June also suffer from an attack by the second brood. The life of a maggot is from three to four weeks.

The best means to protect from the maggot is to plant cabbages and radishes in a new place each year, as far removed from the ground on which they were raised the preceding year as possible. The most successful *remedy* that we have yet found is an emulsion made either from crude carbolic acid or from kerosene. A quantity of this emulsion, prepared according to directions given under "Insecticides," is poured around each plant sufficient to wet the roots at about the time the maggots are expected to appear, or even immediately upon the first appearance of injury. Mr.

Slingerland of the New York experiment station has studied the cabbage maggot extensively and he favors the carbolic acid to the kerosene emulsion. He also had good success with bisulphide of carbon by putting it around the roots with a McGowen injector. Prof. Cook had very poor success with the bisulphide of carbon in light or sandy soil, but in clay it worked well.

"THE CABBAGE WORM" (*Pieris rapæ* Linn.).

Fig. 44.—Cabbage Butterfly.

The adult of this common caterpillar is a white butterfly (Fig. 44). The female lays her small yellowish eggs on the cabbage leaves, and they soon hatch into the green, velvety caterpillar that makes such havoc with the cabbages the rest of the season. There are at least two broods, but they are so irregular that there seems to be only one continuous brood. Although there is a disease that kills many, and many more are killed by predacious insects and parasites, yet we can never rely wholly upon them to keep the cabbage worms in subjection. It is encouraging to know that in large cabbage fields this caterpillar is not common enough to do much harm. The farmer who raises a few for his own use is the one who must fight them if he secures cabbages worthy the name. Many perfectly absurd remedies are in use for this pest. There are also many practical ones, the most common of which are the arsenites, pyrethrum, kerosene emulsion, and hot water. For a farmer with only a few cabbages in his garden near the house, my preference is the last one. The cabbage will endure water almost boiling, to within 30 degrees at least, while the caterpillars are killed by water above 130 degrees, giving a range of temperature of 50 degrees or more, inside of which one can surely guess near enough. It takes little time to heat a kettle of water, carry it to the garden and pour it over the cabbages, after which they will be clean, and left free from all powder and dirt.

THE ZEBRA CATERPILLAR (*Mamestra picta* Harr.).

Fig. 45.—Zebra Caterpillar and Imago.

Sometimes in the latter part of the season this yellow and black banded caterpillar becomes plentiful enough on cabbages to need treatment. If so, use the same remedy as for the common cabbage worm.

CABBAGE APHIS (*Aphis brassicæ*).

Although not so destructive to cabbages as the cabbage worm, the little downy green lice, that cover so many of the cabbages in the fall, are about as unpleasant a pest as we have, and they take a great deal of nutriment from the plants, too. Late in the fall eggs are laid on the cabbage leaves for the next year's brood, and for this reason all refuse leaves and stumps should be burned, or gathered and fed to stock. This will greatly aid in reducing the number of lice for the next season. As a remedy, kerosene emulsion is the most effectual, but it must strike the lice on both upper and under side of the leaves, and wherever found, else many will escape.

CABBAGE-LEAF MINER (*Plutella cruciferarum* Zell.).

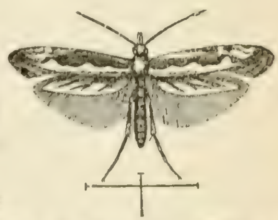


Fig. 46.—Moth of the Cabbage Leaf Miner.

Occasionally this leaf miner has proven harmful to cabbages, rutabagas, and similar cruciferous plants, by the young larvæ boring into the leaf between its upper and under surface and raising a blister by feeding on the substance of the leaf and making small dead spots before the larvæ mature.

Remedies.—Paris green is recommended for the miner, but I believe hot water, as advised for the cabbage worm, will prove more effectual.

INSECTS OF THE CUCUMBER AND SQUASH.

THE STRIPED CUCUMBER BEETLE (*Diabrotica vittata* Fabr.).

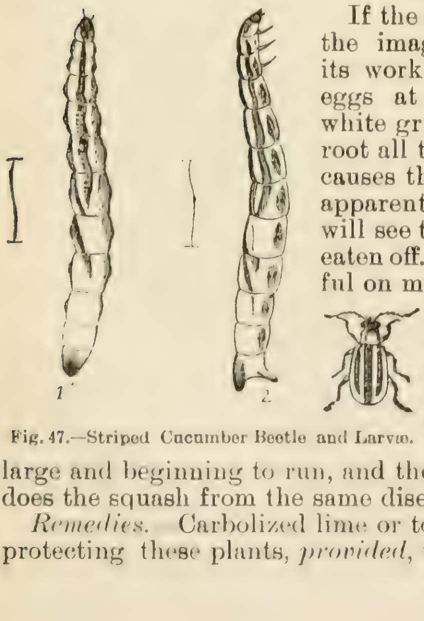


Fig. 47.—Striped Cucumber Beetle and Larvæ.

If the only harm done by this insect was by the imago above ground, we could control its work much better, but the beetle lays its eggs at the base of the roots and the little white grubs resulting from them feed on the root all through their development. This often causes the plants to suddenly die without any apparent cause, but if the plant is pulled up, we will see that the root is badly gnawed or entirely eaten off. The same beetles are equally as harmful on melons and nearly as bad on squashes. There is also a plant disease that is carried by these striped beetles, and if we can keep them from the plants we in a large measure prevent this disease from its attack. The disease makes its appearance when the plants are large and beginning to run, and they die as suddenly and unexpectedly as does the squash from the same disease.

Remedies. Carbolized lime or tobacco dust are either one very good in protecting these plants, *provided*, we dust the plants before the beetles

have gotten a taste, and *provided* we apply often enough to keep the plants well covered. Where one has only a few plants, a very sure protection is to cover them as soon as the beetles appear, with a box or frame that is covered with netting, so as to exclude them from the plants but admit the sunlight.

SQUASH VINE BORER (*Melittia ceto* Westw.).

Many reports of injury to the squash by the borer have reached us from various parts of the state. No doubt quite a percentage of this work is due to the disease spoken of under the striped cucumber beetle, yet we know that the borer is a dreaded pest in many localities around us. The borer is closely related to the peach-tree borer and works in the base of the stem and top of the root so that it and its work can readily be found if a plant dies and the borer has been the cause of its death.

Remedies.—If the larva is once inside the plant there is nothing that will save it except making a longitudinal cut in the stem and digging the larva out The moth lays its eggs at the base of the plant soon after it is up, or at least before it has run far. Some have had good success in spraying the stems occasionally with Paris green at this time. The moth very often deposits her eggs on the under or protected side of the plant, so care must be used to apply the poison there also. Lime should be used as the vines are easily injured by the arsenites. The best remedy, so far as I know, is a repellant consisting of cobs, rags, or sticks dipped in coal tar every few days and placed in a little row around the hills. The moth dislikes the odor and will not deposit her eggs on the surrounded plants. Planting summer squashes among the late varieties and then burning the early plants is a good protection for the late plants. No borers have yet been found in the state to my knowledge, but many supposed cases have proven to be the disease communicated by the striped cucumber Beetle. For treatment of this disease, see "Striped Cucumber Beetle."

SQUASH BUG. (*Anasa tristis* De G.).

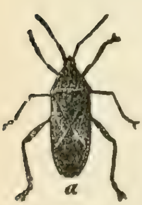


Fig 48.—Squash Bug.

To growers of the squash this large brown stink-bug is far from a welcome guest. It winters over as an adult under boards and in protected places, and with a hungry longing it watches for the appearance through the ground of the squash vines, that it may again feed and be satisfied. While sucking the sap it breeds extensively on the plants, as can be readily seen by the clusters of reddish-brown eggs on the leaves and later by the young bugs.

Remedy.—This is one of the few insects for which we can suggest no better remedy than catching by hand and killing. We can kill the eggs and young bugs with kerosene emulsion, but it is the old bugs early in the season that do the most harm, and these are affected but slightly by this remedy. Hot water will kill the plants much quicker than the bugs. It has been proven in many cases that much of the injury attributed to the bug has really been caused by some one of the hidden squash insects already spoken of or the squash vine disease. Care should therefore be taken to be sure what is doing the harm before treating.

DISEASE OF THE BEAN.

ANTHRACNOSE (*Glœosporium lindemuthianum*).

The spots upon the pods, stems, and leaves of beans, particularly the wax-podded varieties, are commonly called "rust," but are really due to a species of anthracnose. At first it shows as a reddish-brown spot, but the center soon becomes white, finally turning to a light brown. The spots enlarge and if sufficiently numerous several of them will grow together and cover a large part of the surface of the bean pod or leaf.

Upon the pods the portion attacked soon sinks below the surface and the disease may spread to the beans themselves, causing them to shrivel.

The disease is particularly troublesome in damp seasons, or when beans are grown in a low, moist place. If planted upon high well-drained soil, where there will be a current of air, the danger of injury will be lessened.

The use of copper sulphate solution also seems to prevent the spread of the disease. It should be used very weak, not stronger than one pound to 500 gallons of water, and will then do no harm, and with fairly favorable conditions will keep the beans practically free from disease.

INSECTS OF THE PEA AND BEAN.

PEA AND BEAN WEEVILS.

Although these insects belong to different species and always work in the seed of the one plant which the name indicates, yet their habits are alike, and the same treatment will kill one as readily as the other. The eggs are deposited by the beetles on the outside of the pod and when they hatch the young grub, while yet very small, gnaws through the pod, into the young seed and there develops. The peas seldom contain more than one grub each, while a single bean may contain as high as twenty grubs. It is better not to plant "buggy" peas or beans if it can be avoided, even if the weevils are not alive in the seed. The germ is not usually destroyed by the weevils, but the seed is weakened by the loss of what has been eaten from it.

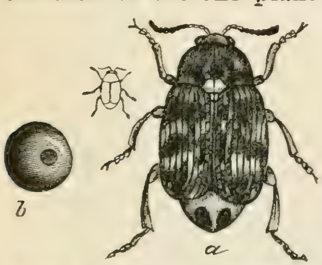


Fig. 49.—Pea Weevil. *Bruchus pisi.*

Remedies.—Place in a tight jar and use bisulphide of carbon, or immerse in hot water for a few minutes, or place in an oven for a short time and bake them, being careful that the temperature is not much above 145 degrees, Fahr. In separating "buggy" from sound peas, drop into water, when the "buggy" peas will float and the sound ones sink to the bottom.

DISEASES OF THE TOMATO.

This plant is attacked by a number of diseases, which are commonly known as rots of the fruit and blights of the leaves. The form of rot caused by the fungus *Macrosporium solani* is perhaps most troublesome. While other fungi are often found associated with it, the most common form of rot, which so often appears at the blossom end of the fruit, is attributed to it. While some varieties are more subject to the attack of this disease than others, it seems most likely to appear upon plants that have been subjected to some kind of check, and for this reason it is perhaps most prevalent in hot, dry summers, although a cold, wet season seems to invite the development of the disease.

It shows at the point attacked as a greenish-brown spot, which gradually enlarges and may involve a greater part of the fruit. The diseased portion seems to sink below the surface of the surrounding healthy parts and the cuticle may turn yellow and finally white. If conditions are favorable, a crop of olive-green spores will develop upon the diseased parts, by which the rot will be distributed.

By the use of Bordeaux mixture soon after the fruits have set, repeating it once at the end of two or three weeks, and if the rot still persists applying copper sulphate solution, the crop can be grown with but little danger from the rot. The frequent use of the cultivator, in dry seasons, will also lessen the check to the plants and the danger of attack by the fungus.

While it is not certainly known that the use of fungicides will prevent the blighting of the leaves, it seems to have a good effect, and may be found desirable for the purpose.

INSECTS OF THE TOMATO.

THE TOMATO SPHINX. (*Protoparce celeus* Hbn.).

The large green tomato worms frequently annoy people because of their great size and ugly appearance. They are perfectly harmless to handle, and because they are so readily noticed, picking them off by hand is the quickest and simplest remedy we can suggest. They are very hearty eaters and will quite often nearly strip the vines of their foliage. A cut of the three stages in its life history will show the stages of transformation of the sphinx. The pupa will often be plowed up when making garden in the spring. This jug-shape case should be destroyed when found.

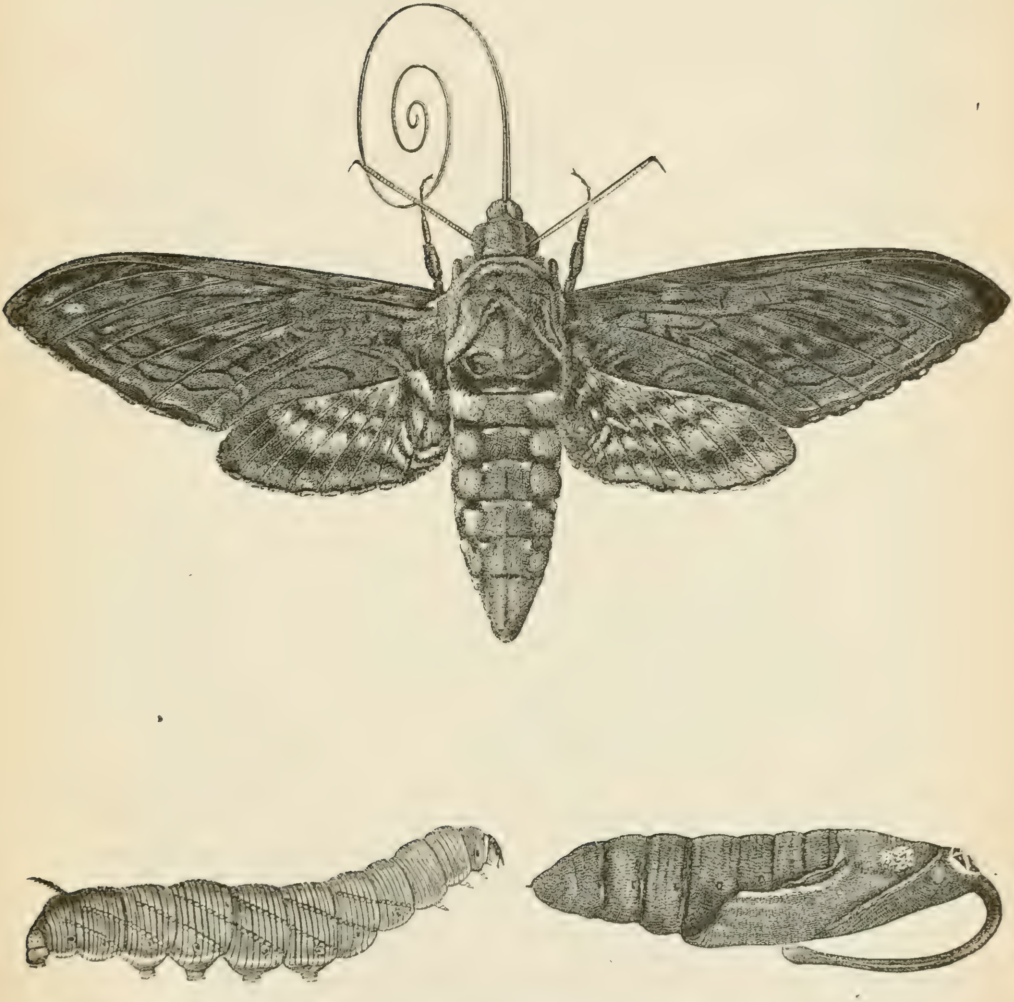


Fig. 50.—The Tomato Sphinx, showing larva, pupa, and imago.

SPRAYING MACHINERY.

The treatment of orchards requires machinery adapted to the purpose, if it is to be performed profitably. While a small bucket pump will enable one to spray a few small trees in the home garden, it does not do satisfactory work in large orchards, and for this purpose some of the more powerful barrel or tank pumps should be used. These should have large air chambers, which will enable them to throw even and continuous streams, and if the pump handle is geared to the wagon wheel extensive orchards can be sprayed very quickly and with but slight expense for labor.

Frequent inquiries are received as to the best pump for orchard spraying, and to afford such information as is in our possession, upon this subject, we have concluded to insert illustrations and descriptions of some of the pumps and nozzles which we can recommend from our trials of them. The firms manufacturing them are some of the largest and best known in the country and will be found entirely reliable. The prices quoted are net for a single pump, but when three or more pumps are ordered at one time we have made arrangements with the firms by which a discount of fifteen to twenty-five per cent. will be given if the cash is sent with the order. If several farmers in a neighborhood club together and send in an order, from two to four dollars can be saved upon each pump.

Among the latest candidates for public favor in the pump line are the Eclipse and Eureka spray pumps made by the Morrill & Morley Co. of Benton Harbor, Mich. The former pump is shown in Fig. 51. It is made in two styles. One has all its parts, except the handle, of brass, while the other has brass cylinder, piston, and valves, with the remaining parts of iron. The first style sells at retail for $20, while the latter costs but $10. As will be seen, this pump stands low down in the barrel, so that there is but slight danger of its tipping over. It is also at such a height that it can be readily worked. The valves and plunger being of solid brass, without rubber or leather packing, the inventors claim that it will be much more durable and that there will be none of the vexatious delays that are so common with many of the other pumps. Being immersed in the spraying material, there is no necessity for a stuffing-box, which is a necessary part of most of the other pumps, and which causes a considerable increase in the friction if tight, or allow the liquid to spurt out upon the man at the handle when loose.

The power is applied at the downward stroke, making it easier than in most pumps, while the small rod from the end of the handle works an agitator, which is quite efficient in keeping the material in suspension.

Another good feature of this pump is that the sliding plate which rests upon the top of the barrel allows the instant adjustment of the pump to any size of barrel or tank. While the brass pump is particularly desirable for the use of the clear solutions of copper sulphate, the heavy iron castings used in the combination pump will make it quite durable.

The Eureka is similar to the combination Eclipse except that it has two cylinders, which together have the same capacity as the single cylinder of the Eclipse. It has no agitator and requires an equal power upon both strokes. A larger-size pump of the Eureka pattern has long brake handles and two agitators. It can throw two large or four small streams and is adapted to work in large orchards.

Both of the above pumps have been used in the station orchards and have given entire satisfaction.

The Church Manufacturing Co. of Adrian, Mich., have recently placed on the market a barrel pump, which is similar, except in size, to their bucket pump, shown in Fig. 60. It has several of the desirable features of the Eclipse and Eureka pumps and for a cheap pump (the price being only $8) it has many things to commend it.

Fig. 51.—Eclipse Spray Pump.

The Bean-Chamberlain Co. of Hudson, Mich., also make an excellent line of pumps, that have been in use for many years in the orchards of California, where they have given excellent satisfaction. The better forms for orchard spraying are mounted upon a platform and are designed to be placed in a wagon with several barrels of water from which the water can

be drawn by means of a hose. They have a cylinder that is lined with porcelain, which gives it a wearing power and enables it to withstand the action of the fungicides. The piston has an adjustable and very durable rubber packing. The water is forced into the large air chamber and is forced out in a continuous stream by the compressed air. This air chamber is of riveted steel and is galvanized upon the inside. In the various sizes of pump, the air chamber varies in size from twenty to fifty inches in height and from two and one half to eight inches in diameter. The size known as No. 1½ is suited to orchards of medium size and sells for about twenty dollars, including hose and nozzles.

The Field Force Pump Company of Lockport, N. Y., were among the first to place spraying pumps upon the market. Their 'Standard' spraying outfit (pump, hose, and nozzle) costs with iron cylinder, plunger, etc., $8, and if brass $10. Their 'Perfection' outfit is more powerful and the cost is $9.50 and $12 respectively. It has a long discharge hose and also a return hose for keeping the spraying materials in suspension. These pumps have their cylinders above the barrel and on this account are less desirable than the Empire Spraying Pumps (Fig. 52) made by the same firm.

The single Empire with suction pipe, return pipe (agitator), 10 ft. of discharge pipe, graduating spray nozzle, and with iron cylinder, plunger, and rod costs $8, or $10 with brass cylinder, plunger rod, and valve-seat. The double Empire (Fig. 52) is heavier, with a larger air chamber, etc., and has two discharge pipes and Vermorel nozzles. The price of this pump is $10 and $12.50 respectively for iron and brass cylinders, etc. As will be seen from the illustration, these pumps have their air chambers within the barrels, thus doing away with the objection urged against the 'Standard' and 'Perfection' outfits. They also have quite a long handle and are supplied with brass strainers over the suction pipes. The Field pumps use leather valves and have stuffing-boxes.

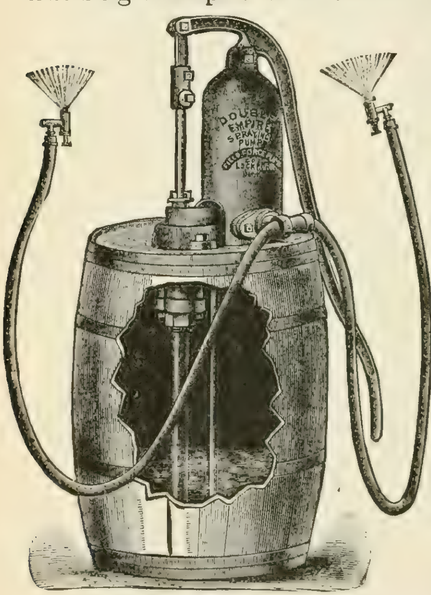


Fig. 52.—Empire Spray Pump.

The Gould Manufacturing Company of Seneca Falls, N. Y., are also well and favorably known. They make the 'Standard' Double Acting spray pump with brass-cased plunger and brass-lined cylinder which they furnish as shown in the cut (Fig. 53) with suction pipe and two discharge pipes with nozzles, for $16.50, or with one discharge hose and nozzle for $13.50. This is a very powerful pump, and as it is arranged to be fitted to the side of a barrel there is less necessity for having the cylinder inside. This pump is also made without the air chamber shown in the illustration, for one dollar less than the above prices. It, however, has a hollow plunger which to a certain extent serves as an air chamber. In a general

way the Gould pumps resemble those of the Field Company in their construction

The Nixon Nozzle and Machine Company of Dayton, Ohio, manufacture the Climax spraying machinery. Their pumps are light but strong and well made. Their Climax Tripod pump (Fig. 54), has brass working parts. The No. 2 has one and one half inch cylinder with four feet of suction hose, twelve and one half feet of discharge hose, and two Climax nozzles. No. 3 has a two inch cylinder, suction hose, two lengths of discharge hose, and four nozzles. They are supported upon a pipe tripod.

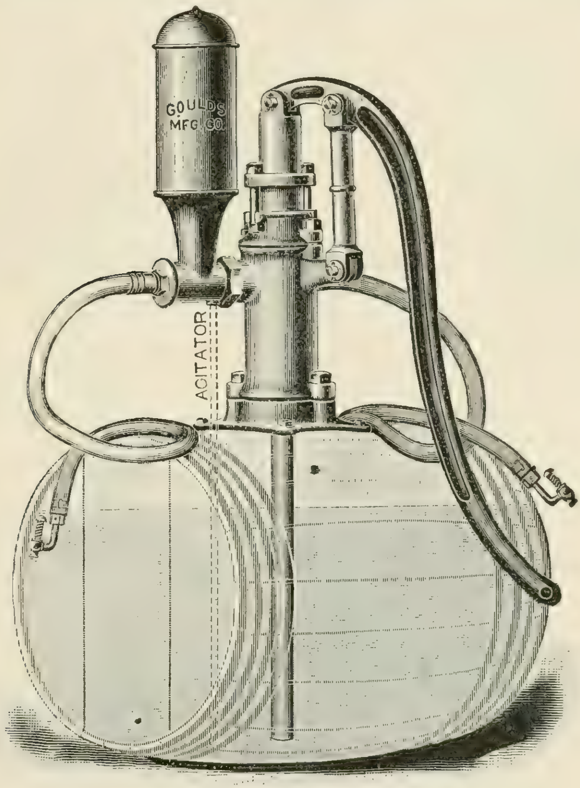


Fig. 53.—Gould Spray Pump.

The cost is $15 and $20 respectively. Either of the above pumps can be fastened to a barrel if desired, and an automatic agitator as shown in Fig. 55 can be added at an expense of one dollar.

For orchard spraying when the number of trees is not large, any of the above pumps can be fastened to a barrel and by placing this in a wagon, or on a stone-boat, the material can be readily hauled from tree to tree. For the spraying of grapes, raspberries, and other small fruits, the truck shown in Fig. 56 is a great convenience. The truck itself is well worth having as, when not in use for hauling the barrel, a cart body can be substituted for the latter and a very handy cart can thus be made. These trucks are sold both by the Field Company and by the Lansing Wheelbarrow Works.

Fig. 54.—Climax Tripod Pump.

Fig. 55.—Nixon Climax Pump with agitator.

Fig. 56.—Barrel Truck for Spraying.

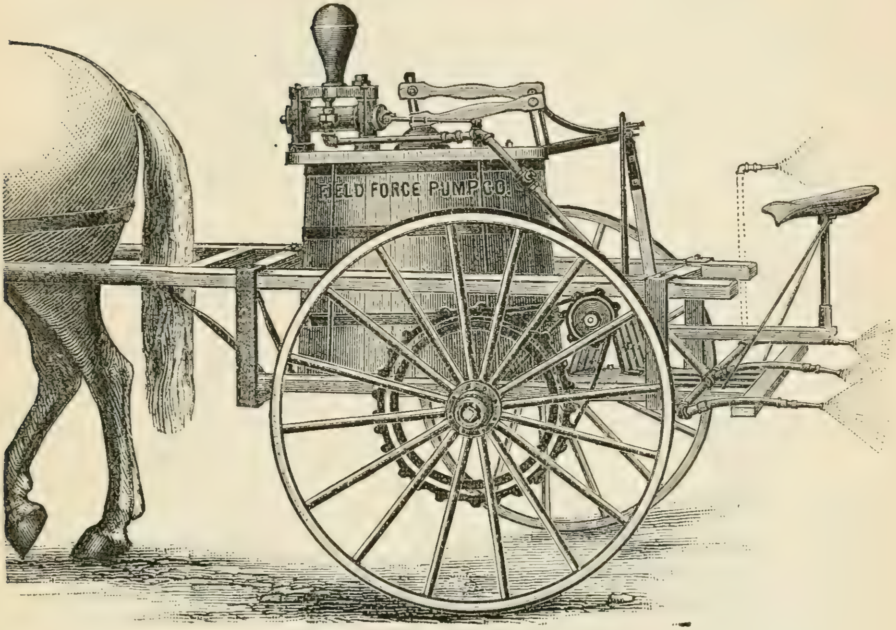


Fig. 57.—Victor Spraying Machine.

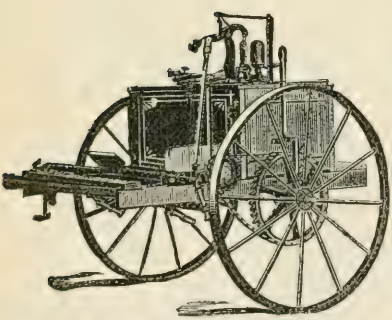


Fig. 58.—Nixon Spraying Cart.

When one has large orchards, it is desirable to have some means of carrying a larger quantity of water than can be taken in a barrel. For this purpose we have mounted a tank that holds twelve barrels upon a wagon gear, and by using a double acting pump that can be geared to the wheels by means of sprocket wheels and an endless chain, have been able to get over a large number of trees in a day. We have known of others who have placed several barrels in a wagon, and by connecting them by pipes have thus been able to increase the rapidity of spraying.

Nearly all of the manufacturers of spraying machinery can furnish spraying carts. These are generally two-wheeled affairs to be drawn by one horse, with either a square or round tank. The pump is geared to the wheels by means of a sprocket wheel and endless chain.

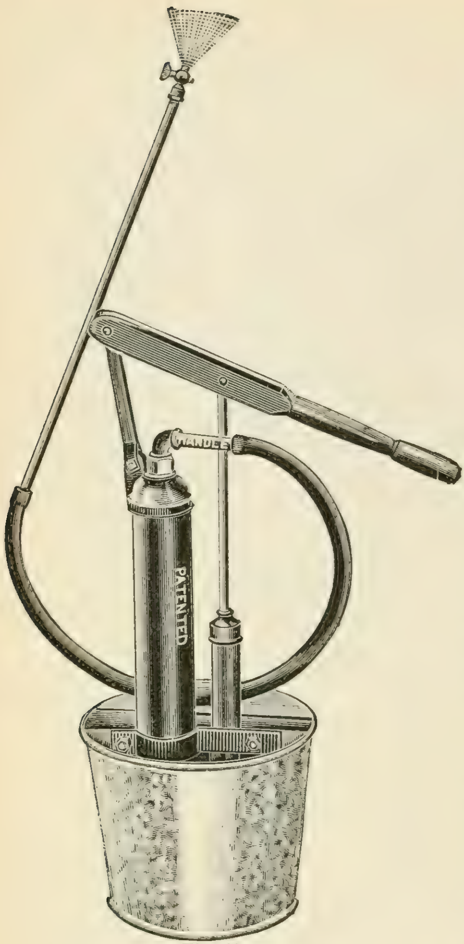


Fig. 60.

In Fig. 57 is shown the Victor spraying machine made by the Field Pump Co., while the one furnished by the Nixon Co. is shown in Fig. 58. As will be seen from the illustrations, either of these machines can be used for the spraying of potatoes, strawberries, and other low plants as well as orchard trees.

BUCKET PUMPS.

When one has only a few trees or plants in one's garden, some of the so-called bucket or hand pumps will be found to do very good work. One of the best of these is made by the F. J. Myers & Bro., Ashland, Ohio. (Fig. 59.) It is simple in construction and quite strong and durable, so that it is not likely to get out of order. Its air-chamber capacity is ample and it throws a steady and powerful stream.

For use in a small garden or orchard, or about the house and stable, one of the most satisfactory pumps that we have seen is made by the Church Manufacturing Co. of Adrian. It works very easily and by means of its large air chamber (Fig. 60) throws a regular stream.

The Deming Co. of Salem, Ohio, also make an excellent bucket pump known as the "Success." Among the other manufacturers of bucket pumps are the firms mentioned above as manufacturers of orchard pumps, and Wm. Stahl, Quincy, Ill., P. C. Lewis, Catskill, N. Y., and W. & B. Douglass, Middletown, Conn.

NOZZLES.

Fully as much depends upon the nozzle as on the pump, if one would spray successfully. The ideal nozzle is one that is not easily clogged and which if it does become stopped up can be readily freed from obstructions; for orchard trees it is desirable that it should throw a thin, fan-shape spray, while for bush fruits it is better if in the form of a fine mist. If possible it should be readily adjustable for either kind of work, and while not likely to get out of order, it should be so constructed that it can be readily taken apart. For orchard spraying, the McGowen nozzle, manu-

factured by J. J. McGowen of Ithaca, N. Y., satisfies the above conditions. It has a plunger that is adjusted by a set screw and controlled by a stiff steel spring; if in any way the orifice becomes clogged, the force of the water will push out the plunger against the spring, thus allowing the obstruction to pass out through the full-size opening. The size and character of the stream can also be varied at will. The price of this nozzle is two dollars.

Fig. 59.—Myers' Bucket Pump.

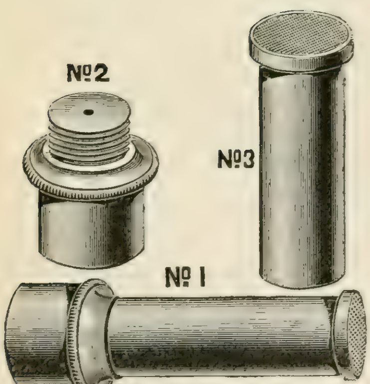


Fig. 61.—The Nixon Nozzle.

The Nixon nozzle (Fig. 61) consists of three parts, of which No. 2 is a nipple with a small perforation at the end, through which a solid stream is thrown, which finally breaks into a fine spray. The cap (No. 3) screws on over the end of the nipple, and has its end covered with fine brass netting which breaks up the stream into a mist-like spray. This nozzle does excellent work on low trees and on bush plants, but it is hardly satisfactory for use upon trees so tall that they can not be reached with the spray through the netting. Another objection to this nozzle is that it is likely to clog, and yet, as stated above, for many purposes it is an excellent nozzle. It retails for one dollar.

The so-called Vermorel nozzle (Fig. 62), as made by the Gould Company and others, is constructed on the same principle as the old Cyclone nozzle, with the addition of a degorger by which any small obstruction can be removed from the orifice. It is an excellent nozzle for Bordeaux mixture in particular, when small plants are to be sprayed, as its spray can only be equaled by that of the Nixon.

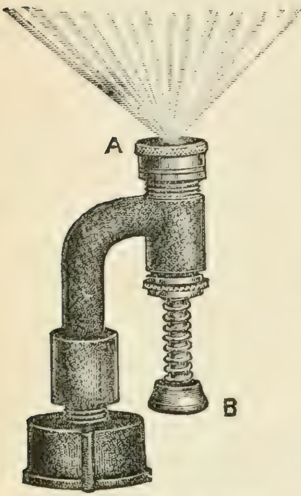


Fig. 62.—Vermorel Nozzle.

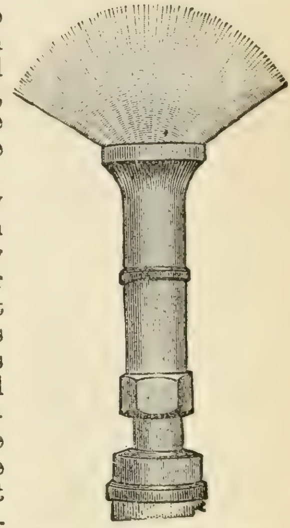


Fig. 63.—Graduating Nozzle.

The Graduating Spray nozzle has been much used, and can be readily adjusted to throw either a solid stream or almost any kind of spray. Its principal objection is that it readily clogs, and although by the removing of a screw it can be taken apart and the obstruction removed, it often causes a considerable delay, especially if a geared machine is used, as the hose may burst. Another objection to this nozzle, especially when small plants are to be sprayed, is that it is wasteful of material.

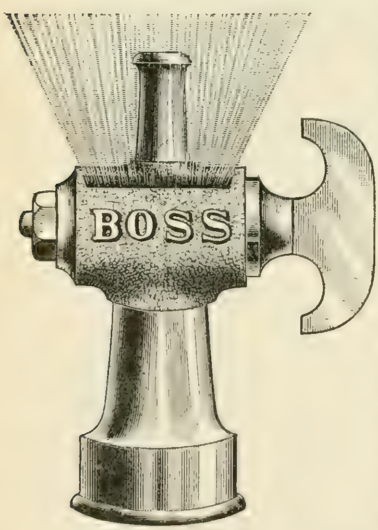


Fig. 64.—Boss Nozzle.

The Boss nozzle was one of the first brought out and is still much used. It is shown in Fig. 64.

F. E. Myers & Bro. make a very ingenious nozzle, which can be adjusted at will to throw any kind of spray. The stream leaves the nozzle through a small, round hole and is thrown against a projecting portion of the nozzle, at any desired angle, and in this way the character of the spray can be varied. If the nozzle becomes clogged it can be freed from the obstruction in a simple manner. It is called the Bordeaux nozzle.

One of the best of the new nozzles for almost any kind of spraying is a modification of the Vermorel, made by the Bean-Chamberlain Company.

Instead of having a movable degorger, this nozzle has the degorger stationary and the obstruction is removed by pressing the end of the nozzle against a branch of a tree or some other object, and slipping it back against the degorger.

When using the nozzle at the end of an extension this makes the removal of the obstruction much simpler than in the old way.

The Myers Bros. also make a nozzle, shown in Fig. 65, which works well with solutions that are not likely to clog.

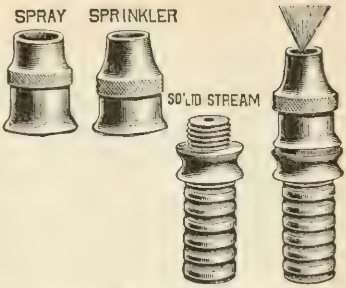


Fig. 65. Myers Bros.' Nozzle.

PIPE EXTENSIONS.


Fig. 66. Pipe extension.

Even when spraying low plants it is desirable to have at the end of the hose a short rod with the nozzle at one end and a shut-off valve at the other by which the stream can be cut off while passing from plant to plant, and whenever it may be desirable to stop spraying for a moment. In this way the material will be saved and the air pressure will be maintained so that there will be no loss of time when spraying is resumed.

A similar arrangement is particularly desirable when spraying tall trees, as, in addition to the advantages mentioned above, by the use of a long piece of gas pipe with a valve at one end and the nozzle at the other, a fine spray can be carried to the top of the highest orchard trees.

In Fig. 66 will be seen a short lance, with a degorger for the removal of obstructions from a Vermorel nozzle,made by the Gould Manufacturing Co., which is very useful upon low plants. A pipe extension in two lengths, one or both of which can be used as is desired, made by F. E. Myers & Bro., is figured in Fig. 67. For the best work it should have a shut-off at the lower end. Better even than the gas pipe is the bamboo extension, which can be obtained in any length up to ten or twelve feet.


Fig. 67. Long Pipe Extension.

KNAPSACK PUMPS.

The so-called knapsack pump consists of a copper tank holding four or five gallons, arranged with straps so that it can be attached to the back. The pump and air chamber are inside the tank. The attachment of the handle and hose are shown in Fig. 68 which illustrates the Eclipse Knapsack sold by the Morrill & Morley Co.


Fig. 68. Knapsack Pump.

POWDER GUNS.

For the application of insecticides in a powder form some of the powder guns can often be used to advantage. Of these one of the best known is Leggett's powder gun, manufactured by Leggett & Co., New York, which is sold by most seedsmen. As shown in Fig. 69, it is provided with a number of attachments adapting it to use with a variety of plants. When carefully handled it will do good work, but it sometimes troubles by the breaking of the agitator, owing to the packing of the powder. The Comet powder gun, made in New Haven, Conn., is constructed upon similar principles and has given even better satisfaction as used here.

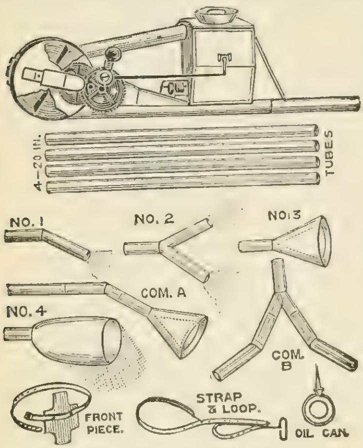


Fig. 69.—Leggett's Powder Gun.

Very simple contrivances are often used for application of the powder which do good work. It may be placed in coarse sacking or in muslin, but a more common form of powder distributor is the tin pail with a finely perforated bottom. If these are shaken over the plants, a fairly even distribution of the powder will be made, but it will not be applied as rapidly as with a powder gun.

MANAGEMENT OF SWAMPS.

MUCK AND MARL.

R. C. KEDZIE.

Bulletin No. 115.

The large number of muck swamps and deposits of marl in Michigan, and the numerous letters asking for information about the treatment of these materials, seem to justify a bulletin on this subject.

Swamp muck is formed by the imperfect decomposition of vegetable matter, consisting of the more or less decomposed remains of marshy plants, together with the materials which have been blown in or washed in from the surrounding land. These materials when covered by stagnant water undergo a slow and incomplete decomposition, forming what is known as peat in Europe and muck in America. In cool and moist climates it is more abundant than in warm and dry climates where vegetable decomposition is more rapid. It is more common in the central and northern parts of this state than in the southern counties.

KINDS OF MUCK.

There are two varieties of muck, which differ in their properties and uses.

1. Powdery muck, found on the surface of the muck bed, which is of a deep brown color, does not stick to the fingers, has no acid property, and closely resembles the mould or organic matter of the soil. If pressed upon moist blue-litmus paper it does not redden the paper, thus showing the absence of acids.

2. Under this superficial layer of powdery muck is a variable depth of a nearly black, sticky, adhesive mass that cuts like cheese and soils the fingers when handled. It is usually quite acid, and when a slip of blue-litmus paper is pressed against it for a time the paper is reddened, revealing the presence of an acid. This cheesy muck contains a large amount of water, from 50 to 80 per cent., and if rapidly dried it shrinks and cracks and forms a peaty mass that is fit only for the fire. This is the coaly humus of European writers and is as useless for the land as so much stone coal. It may remain for years a useless encumbrance on the ground.

INFLUENCE OF FROST AND WEATHER.

If this muck is thrown up into long piles or windrows in the fall and left to the action of frost and weather during the winter, it will break down into a soft, crumbly mass, like the powery muck found on the surface of the swamp, will have lost its acid property and much of its water. Six months' weathering in sharp winter weather will change its character almost entirely and fit it for use on the land without fear of forming useless lumpy masses. The evaporation of its water will save about half the cost of moving it to the field.

COMPOSITION OF MUCK.

Besides a variable amount of water, muck contains an organic or combustible material, a quantity of ash, and an uncertain amount of soil carried into the swamp by wind and water. The ash consists of carbonates of lime, magnesia, and potash, sulphate and phosphate of lime, and oxide of iron; or the usual ash materials found in vegetable matter.

The organic matter of muck consists for a large part of a mixture of organic acids, and is distinguished from the relatively large amount of combined nitrogen it contains, from one to two and one half per cent. A part exists as ammonia in combination, which may be set free by heating the muck with caustic potash or lime, but the greater part is inert or inactive. It is a great problem in agriculture how to make this inactive nitrogen of muck and of the humus in the soil active and available for the use of plants. In part this is effected by the action of alkaline substances to promote decomposition, such as wood ashes, caustic lime, etc., and by promoting the process of nitrification to bring the inert nitrogen into the soluble and active form of nitrates.

USES OF MUCK.

The uses of muck on the farm may be comprised under two heads.

1. To be applied to other lands as manure.
2. The reclaiming of a swamp and converting it into a field for raising usual farm crops or special crops like celery and cranberries.

I. MUCK AS MANURE.

The powdery muck found on the surface of muck beds, or the cheesy muck made powdery by the action of frost and weathering, and free from acid property, may be applied to any soil deficient in organic matter, and be worked into the soil with benefit. The material may be made more active and beneficial by mixing with each ton of the dry muck two bushels of wood ashes or slaked lime. The muck is especially valuable for making compost with fresh stable manure, using equal parts of muck and manure. Even offensive material, such as night-soil, the manure from the hog-pen, and putrid animal remains may be deprived of all offensive properties by mixing with muck. But in no case should the cheesy muck be used either for direct application to the land or for composting. Let frost and weathering break down and sweeten this muck before using.

II. RECLAIMING A MUCK SWAMP.

Serious mistakes have been made by the attempt to break up and cultivate a muck bed and putting in ordinary farm crops. The first step in reclaiming such swamp is to thoroughly drain it to the depth of three feet, removing surplus water and causing the muck to settle and consolidate, changing its spongy texture and making a firm soil. In this way it becomes capable of holding moisture, and loses its "frostiness" by becoming a better conductor of heat from the subsoil. This drainage and consolidation of mucky lands are necessary conditions for reclaiming and preparing for successful cultivation. The evidence of improvement is seen in the settling of the soil, the gradual disappearance of wild grasses and sedges, and the appearance of boneset and red-top and June grass. These changes are promoted by a top dressing of wood ashes; even leached ashes if applied in liberal doses will make a great improvement. Sometimes by sowing seed of red-top on the surface of such consolidated swamp, and lightly scatching it in with a light harrow, a good meadow may be secured, giving a fair crop of hay for a number of years.

When it is decided to plow up a partially reclaimed muck swamp, this should be done late in the fall, and only a thin slice of the cheesy muck brought to the surface; thirty bushels of slaked lime should be scattered over each acre and this incorporated with the soil by harrowing.

KIND OF CROP.

It is a matter of importance what kind of crop to raise on such land at the outset. The truck crops, cabbages, onions, white turnips, and potatoes usually succeed well; also beets and mangols; corn often does well, but oats and wheat often give a large growth of straw but very small crop of grain. The hay crop—timothy and red-top—often gives large returns, and some farmers have grown rich by raising timothy hay on reclaimed tamarack swamps. The meadow often prepares the ground for grain crops. If the muck is not very deep, the time required for bringing such soils into condition for raising rain is much shorter. In fact, the application of one or two inches of any kind of soil to the surface of a muck swamp will greatly increase its productive capacity.

Special crops, such as celery, cranberries, and peppermint have given the largest profit in muck farming. I have no experience in these special crops and must refer inquirers to those who devote special attention to these crops. One fact has aroused my attention, viz.: that peppermint farmers place little value on their peppermint hay or the material remaining after the peppermint oil has been distilled, whereas, analysis of peppermint hay shows it is nearly as valuable as timothy for stock food.

MARL.

The term marl is applied in this state to a whitish deposit found at the bottom of shallow lakes and ponds and often in a layer below the muck in many swamps. There are numerous deposits of this material in this state, and it differs so much in appearance from the neighboring soil that many farmers have sent specimens to the college to "find out what it is and

what it is good for." The effort will be made to answer these questions in this bulletin.

The whitish deposits found in the bottom of shallow lakes and ponds, in a loose form which readily mixes up with the water to form a mushy mass; and the more solid and chalky masses found at the bottom of muck beds, sometimes like putty in texture while wet, but becoming crumbly like chalk when dry, and often containing small shells, are marl.

COMPOSITION.

The marls found in this state consist of carbonates of lime and magnesia, oxide of iron, organic matter, and variable quantities of sand and clay. The most abundant and valuable material is carbonate of lime. The marl often contains small quantities of potash and soda, and occasionally phosphate of lime. These add to the value of the marl as manure, and a marl in Otsego county that contained one and a half per cent. of phosphate of lime was found to greatly promote the growth of crops when liberally applied to the soil.

TESTING MARL.

The essential material in marl is the carbonate of lime, with a less amount of carbonate of mangesia. When any strong acid is poured over marl, the carbonates are decomposed and the mixture will foam up, the same as a mixture of cooking soda and vinegar, the effervescence being caused by the escape of carbonic acid. If a material supposed to be marl is placed in a strong acid and there is no foaming or effervescence, it shows the asbence of carbonates, and the material is not marl, but most probably is clay.

A cheap and good method of testing marl is the following: Muriatic acid can be found in all drug stores, and it should be sold for not more than ten cents per pound, as its first cost is less than three cents. Pour a fluid ounce (about a wineglassful) of this acid into a quart fruit jar, or large bowl, and add two ounces of water; into this dilute acid pour a teaspoonful of the powdered marl, and notice the foaming. If it foams up briskly it is marl and probably of good quality. If it dissolves completely it contains no foreign matter and is of excellent quality. If it contains any sand this will be seen at the bottom of the jar and easily recognized; if the marl contains clay or organic matter a gray scum will appear on the top of the foam, and when all chemical action has ceased, a cloudy mass or fine mud will gather at the sides of the jar or sink to the bottom. A small amount of clay will make a large showing of this muddy mass, and may thus mislead the farmer in regard to the value of his muck. A better estimate can be made by observing the amount of foaming.

For testing marl the muriatic acid, or nitric, is much better than sulphuric acid or oil of vitriol, because they form soluble salts, while sulphuric acid forms the insoluble sulphate of lime or gypsum.

Where muriatic or nitric acid can not be obtained, strong vinegar may be used, putting a teaspoonful of the marl into a tumblerful of vinegar placed in the fruit jar without diluting it with water. This testing with acids should not be made in metallic vessels.

A popular test for distinguishing marl from clay may be made by placing a lump of the material in a basin of water and leaving it undisturbed for a time. If it is marl it will crumble down into a loose mass, but if it is clay it will be little changed by the water.

USES OF MARL.

Marl is sometimes found so pure that it may be burned for lime for the masons' use where it can be got in solid masses fit for the lime kiln. But for the farmer its main value is for a fertilizer (though the farmer's wife may use it for scouring purposes in place of whiting if it is free from sand and grit). When marl is found on or near the farm, it is the cheapest lime fertilizer he can use, as it costs nothing but the expense of moving. It approaches in composition the chalk of the English farmer, and like chalk it may be used lavishly without fear of injury as it is "mild lime," and has no caustic properties like quick lime.

Lime is a necessary material in every fertile soil, and no crop can grow in its entire absence, and every crop removes some of the soil supply of lime. But the use of lime is not confined to furnishing the small amount removed by crops. A soil may have a relatively small amount of potash and yet raise good crops if lime is present in good supply. The soils of limestone regions are distinguished for their fertility.

One of the good offices of marl is to promote nitrification or the conversion of the inert nitrogen of the humus in the soil into the active form of nitrates for the use of growing plants. Nitrate is the material commonly in greatest demand for crops on worn out and run down soils. This mild form of lime or carbonate is a great promoter of nitrification in soils containing a good supply of humus. A good dose of marl may thus increase the fertility of a soil for many years, but unless the supply of vegetable matter in the soil is kept up by farm yard manure, by green manuring, or some other way of supplying humus to the soil, the good effect of marl disappears after a time. It is a significant fact that *muck* and *marl* are often found together in the immediate neighborhood of light and infertile soils. Muck and marl would make a good team for many a poor farm.

Marl has a certain alkaline property and will neutralize the acids sometimes found in poor soils and will decompose such salts as sulphate of iron, which will render any soil barren that contains one per cent. of the salt. Any soil to be fertile must be either neutral or alkaline, and every acid soil will fail to raise good crops. The mild carbonate of lime found in marl will most cheaply and safely secure this prime condition of fertility.

WEATHERING MARL.

As taken out of the lakes and marl beds, the marl contains a large amount of water, a useless load to transport. If the material is thrown up into heaps and exposed to the weather it breaks down into a loose mass containing much less water. This dryer and looser mass is then in good condition to be carried unto the fields and ready to be incorporated with the soil.

One serious difficulty found in handling the marl found in shallow lakes is to get it on the land and in fit form for handling. As it lies in the

water it has a consistency approaching putty, but when the attempt is made to shovel it into a boat to carry it to land it breaks up into a slimy mass and runs off the shovel or becomes a sticky mud in the boat and hard to unload. I found the marl in Grayling lake could be easier lifted with a dipper than by a shovel; a little disturbance of the marl in the water made it a semi-fluid mass very difficult to shovel. It then occurred to me that by a rotary pump the material could be lifted into a spout above the water and run upon the shore where the water would sink into the sand and leave the marl to dry and harden till it was fit for transportation. I had a pump rigged like the endless belt of a grain elevator, but the parties who had it in charge reported that the buckets did not empty themselves and the pump was a failure for that reason. I never had a chance to try it, but have thought that if the marl had been sufficiently stirred up with the water, a semi-fluid mass might have been secured that would empty out of the buckets and flow off by the gutter to the land. Perhaps some more ingenious person may yet solve the problem.

KINDS OF SOIL BENEFITED BY MARL.

The soils that receive the greater benefit by a dressing of marl are light, sandy soils having a fair supply of vegetable matter or humus. If there is very little humus the benefit is not so marked. The soils that run to moss and bunch grass need a good supply of marl So also, where there is a large excess of vegetable matter, and decomposition is slow and lingering, as seen in many of the muck swamps, a dressing of 50 to 75 bushels per acre *applied to the surface* will do much to bring them into cultivation.

To secure the best results from marling the material must be kept near the surface. This is one reason why marl at the bottom of a muck bed does no good.

The beneficial action of marl on stiff clay lands is much less than on sandy soils. If applied in such quantity as to change the physical quality of the soil, in doses of 30 to 50 tons to the acre, a permanent benefit is conferred upon such land. But one needs to count the cost before undertaking so expensive a job.

Marl may be laid upon the land at any season, but the application in late fall or early winter, so as to secure the action of frost, will give better results. This is especially true of grass lands. For grain crops it may be applied at the time of seeding, or it may be plowed or harrowed in, as suits convenience.

R. C. KEDZIE.

POTATOES.

BY L. R. TAFT AND U. P. HEDRICK.

Bulletin No. 119.

Since the founding of the station, extensive experiments have been carried on with potatoes, the results of which have been annually placed before the readers of its bulletins. Of necessity the same ground is often gone over twice, and results of experiments that are not new are given. Among the reasons for their being presented again are that, to a large extent, new readers are reached each year; that the results of some experiments need to be emphasized by repetition; and because there is still a demand for information concerning the experiments, as is indicated by questions asked in farm papers, at fairs and institutes, and by correspondents.

The reader who has the patience to consider with some care the tables found in the bulletin will find considerable there that is valuable; much of the data and a good many dry details are given, that he may be his own judge as to the value of the experiments and as to whether the results warrant positive conclusions. The potato crop, owing to the drouth, was a failure, but failures are often instructive. Thoughtful farmers can get something from them.

TEST OF VARIETIES.

The soil on which the variety tests of potatoes were made this year is a light clay loam, on which strawberries had been grown for two seasons. The ground was plowed in both fall and spring, and during the winter was fertilized with composted manure at the rate of twenty good loads per acre. Planting was done the last day of May and the first day of June, two pounds of each variety being planted in rows of twenty-two hills. They were given flat culture. The cultivator was kept going from the time the vines appeared above ground until the potatoes had set; even during the very dry weather the cultivator went through them once a week. Breed's improved weeder was used for the first two workings, and the culture was very shallow throughout the season.

The growing period was very favorable until the latter part of June, when the drouth, the worst in many years, began and lasted until the end of August. When the dry weather commenced the early potatoes were just forming, consequently a large proportion of them were very small. Many of the late potatoes did not begin to set until after the drouth ended, and had made but little growth when they were killed by the frost. In examining the tables these conditions must be remembered, and allowance made for them.

TESTS OF VARIETIES.

Name.	Date of ripening.	Height of vines.	Yield.				No. of years for which average is taken.	Remarks.
			Large.	Small.	Total.	Average.		
Acme Seedling	Aug. 30	21	61.6	18.3	80	80	1	Quality poor.
Alexander's Prolific	Sept. 4	23	100.6	6.6	107⅓	107	1	
American Wonder	Oct. 1	20	133.3	6.6	140	196	3	A good variety.
Bannock	" 1	22	123.3	33.3	156⅔	203	6	Not very desirable.
Beauty of Hebron	Sept. 17	22	116.6	16.6	133⅓	151	6	
Bill Nye	" 30	23	160	16.6	166⅔	139	3	Tubers irregular.
Bonanza	" 27	20	126.6	20	146⅔	125	4	Tuber soft and flabby.
Brownell's Best	" 20	21	123.3	20	143⅓	168	5	Not desirable.
Brownell's Winner	Oct. 1	21	153.3	10	163⅓	160	5	Good appearance.
Burbank	Sept. 15	22	100	16.6	116⅔	144	2	
Burpee's Extra Early	Aug. 30	23	103.3	26.6	130	123	5	Very small.
Carman	Oct. 1	22	106.6	16.6	123⅓	123	1	Very promising.
Cayuga	Sept. 25	23	155	8.3	163⅓	123	3	
Chautauqua	" 20	20	113.3	6.6	120	181	4	Skin rough.
Clark's No. 1	" 15	23	133.3	16.6	150	196	7	Promising.
Colossal	" 15	20	133.3	26.6	160	160	1	Too coarse.
Columbian Rose	" 25	22	166.6	20	186⅔	273	2	
Copper Mine	" 24	21	153.3	13.3	166⅔	201	6	Reliable.
Cream of the Field	Oct. 1	22	166.6	16.6	183⅓	186	4	
Cream City	Aug. 27	21	93.3	23.3	116⅔	115	3	Poor yielder.
Crown Jewell	Sept. 5	22	100	33.3	133⅓	188	4	A good potato.
Cyclone	" 10	20	50	10	60	60	1	Worthless this year.
Dakota Red	" 20	21	180	6.6	186⅔	237	6	A good yielder but somewhat coarse.
Early Everitt	" 10	20	126.6	16.6	143⅓	152	5	
Early Harvest	" 12	22	126.6	18.6	145⅓	160	6	Reliable.
Early Minnesota	" 5	21	73.3	45	118⅓	133	4	
Early Norther	Aug. 27	22	126.6	30	156⅔	179	2	A good variety.
Early Oxford	Sept. 1	22	140	26.6	166⅔	187	6	One of the best early varieties.
Early Pearl	" 2	23	46.6	23.3	70	185	5	
Early Rose	" 13	22	113.3	18.3	131⅔	189	5	
Early Six Weeks	Aug. 27	20	73.3	16.6	90	122	4	
Early Telephone	Sept. 22	19	100	18.3	118⅓	152	2	
Early Wisconsin	" 20	21	113.3	16.6	115	109	3	
Eclipse	" 15	21	46.6	6.6	53⅓	53	1	A very poor variety.
Empire State	" 25	23	86.6	20	106⅔	173	6	
Farina	Oct. 1	18	132.8	14	146.8	145	4	
Fearnaught	" 1	21	156.6	23.3	180	193	4	
Fillbasket	Sept. 14	22	133.3	23.3	156⅔	126	3	Not desirable.
Fold, One Hundred	" 28	21	110	6.6	116⅔	116	1	Good shape and color.
Freeman	" 8	23	98.6	30	128⅔	191	4	Valuable.
Gardner's Early	Aug. 28	20	60	40	100	140	6	
Genesee County King	Sept. 23	20	106.6	25	131⅔	172	3	Very good.
Gov. Rusk	" 13	22	136.3	18.3	154⅔	172	3	Tubers excellent.
Great Divide	" 10	20	111.6	15	126⅔	126	1	A poor looking lot.
Green Mountain	Oct. 1	17	120.4	4	124.4	130	5	
Halo of Dakota	" 1	22	180	10	190	228	4	Valuable.
Heavy Weight	" 1	20	130	33.3	163.3	163	1	Tubers very poor.
Hicks' No. 12	Sept. 9	22	96.6	23.3	120	168	3	Promising.
Hicks' No. 22	" 3	20	100	33.3	133.3	143	3	Small.
Hicks' No. 71	" 20	21	156.3	13.7	170	170	1	Quite promising.
Hicks' No. 81	" 20	22	153.3	16.6	170	188	3	Tubers irregular.
Hicks' No. 101	" 13	21	166.6	13.3	180	191	3	A good seedling.
Illinois Queen	" 20	20	184.1	8.8	192.9	192	1	Very promising.
Imperator	Oct. 1	22	80	20	100	162	5	Not desirable.
Irish Daisy	Sept. 25	20	116.6	13.3	130	130	1	
Iron Clad	" 14	21	100	20	120	141	3	Not desirable.
Joe Davis	" 20	20	146.6	13.3	160	184	2	Small, irregular.
June Eating	" 1	21	126.6	16.6	143⅓	201	5	Good early variety.
Lazell's Seedling	Oct. 1	18	244.3	12	256.3	296	3	Very good.
Leather Coat	Aug. 30	22	104.5	28.9	133 2-7	175	5	

TESTS OF VARIETIES.—CONTINUED.

Name.	Date of ripening.	Height of vines.	Yield.				No. of years for which average is taken.	Remarks.
			Large.	Small.	Total.	Average.		
Lee's Favorite	Sept. 15	21	173.1	12.2	185.3	206	6	A profitable early sort.
Lightning Express	Oct. 1	22	134.4	12.1	146.5	146	1	
McFadden's Early	Sept. 1	21	90	40	130	173	4	Desirable for early.
Main Crop No. 1	" 15	22	93⅓	16⅔	110	110	1	Good appearance.
Mammoth Pearl	" 20	20	113⅓	6⅔	120	160	2	Very good.
Milwaukee	Aug. 30	21	100	16⅔	116⅔	116	1	
Mrs. Cleveland	Sept. 1	22	80	30	110	178	4	
Mulla	Oct. 1	23	146⅔	10	156⅔	152	3	
Muskrat Choice	Sept. 15	19	93⅓	6⅔	100	100	1	Not promising.
North Pole	" 5	20	50	23⅓	73⅓	73	1	Worthless this year.
Nott's Victor	" 20	22	160	15	175	200	4	
On Top	Oct. 1	24	117 1-5	7 1-5	124 2-5	147	3	
Paris Rose	Sept. 3	21	100	13⅓	113⅔	157	3	
Park Region	" 8	23	150	23⅓	173⅓	181	2	Tubers large.
Pearl of Savoy	" 4	23	180	16⅔	196⅔	183	3	Looks well.
Peterson	" 7	22	96¼	41¼	137½	137	1	
Pres. Lincoln	Oct. 1	22	186⅔	20	206⅔	221	6	Very good.
Prize Taker	Sept. 15	23	123⅓	13⅓	136⅔	136	1	Somewhat promising.
Queen of Paris	" 12	21	153	10.4	163.4	234	4	
Randall's Beauty	Aug. 30	22	63⅓	18⅓	81⅔	160	6	
Reeve's Rose	Sept. 5	22	90	20	110	110	1	Of some promise.
Reed's 86	Aug. 30	21	73⅓	25	98⅓	98	1	Very small.
Rochester Favorite	Sept. 25	22	188⅓	20	208⅓	203	6	One of the best.
Restaurant	Oct. 1	23	153.5	------	153.5	134	3	
Rural Blush	Sept. 13	21	196⅔	15	211⅔	222	5	Still valuable.
Rural N Y. No. 2	Oct. 1	23	200	6⅔	206⅔	153	5	A favorite sort.
Seneca Beauty	Sept. 25	21	153⅓	20	173⅓	192	2	
Signal	" 1	22	90	36⅔	126⅔	199	4	
Sir William	Oct. 1	22	193⅓	16⅔	210	210	1	Very promising.
Snowflake	" 1	20	152	10.4	162.4	162	1	
Stanley	Sept. 17	22	113⅓	8⅓	121⅔	156	3	
Statesman	" 1	21	65	21.6	86.6	86	1	
Storr's Seedling	Oct. 1	21	153⅓	16⅔	170	149	3	
Strong's Alpha	" 1	20	70	23⅓	93⅓	110	2	Not to be recommended.
Summit	Sept. 10	22	151⅔	15	166⅔	237	5	Generally very prolific.
Supplanter	" 20	18	84.7	20.6	105.3	192	4	
Sylvan	Oct. 1	22	110	16	126	188	4	
Thorburn	Sept. 25	22	153⅓	6.1	159⅔	213	6	Good.
Thunderbolt	Oct. 1	22	195.5	------	195.5	154	4	
Tonhocks	Aug. 30	21	100	26⅔	126⅔	175	4	
Troy Seedling	Sept. 20	22	126⅔	26⅔	153⅓	153	1	Tubers very small.
Umpire	Oct. 1	21	173⅓	15	188⅓	188	4	
Vanguard	Sept. 20	22	140	11⅔	151⅔	150	3	
Vaughan	" 5	22	86⅔	13⅓	110	129	2	
Vick's Early Market	" 5	21	111⅔	11⅔	123⅓	159	2	Good early variety.
Vick's Champion	Oct. 1	21	153⅓	13⅔	167	194	3	Desirable.
Victor Rose	Sept. 18	22	93⅓	11⅔	105	105	1	
Wall's Orange	Oct. 1	20	103⅓	40	143⅓	141	4	
Watson's Seedling	Sept. 21	22	130	------	130	162	4	
White Elephant	" 25	21	136⅔	13⅔	150	191	4	Still a good variety.
White Flower	Oct. 1	19	132	10.5	142.5	159	4	
White Prize	Sept. 24	21	133⅓	20	153⅓	153	1	A good new variety.
Wolverine Beauty	" 23	21	100	31⅔	131⅔	169	2	Very good.
Woodbury White	" 27	22	160	13⅓	173⅓	238	2	Desirable.
World's Fair	" 20	20	106⅔	13⅓	120	225	2	Very desirable.

Most of the potatoes of which a record is given, have been grown on the station grounds for several years, and, though good seed has always been planted, in looking up their records we find that nearly every variety has shown a tendency to deteriorate. This accentuates the fact that, in our climate, potatoes can not be grown in their first excellence and purity, year after year, and that it is necessary to change the seed occasionally by getting potatoes from another locality, even though it be not far distant.

The experience with the drouth well demonstrated again the value of continual cultivation during a dry season. Farmers still seem to be in doubt as to whether it is best to cultivate during a drouth. To all such we can positively say that it is best to do so. Begin to cultivate as soon as you can and keep the cultivator going as long as you can. The culture should be shallow and need not be given oftener than once a week. This is a general statement, applying to other crops as well as potatoes.

Data from the records of the last few years seem to show that in the matter of earliness we have about reached the limit, as in this respect the new varieties show but little advance. The standards of quality and productiveness, however, in the early sorts are steadily being raised.

VARIETIES FOR PLANTING.

It is a difficult matter to give a list of potatoes for any great extent of territory, but the following varieties are recommended for Michigan, more particularly the lower part of the state: *June Eating* and *Early Norther* for extra early. *Early Oxford*, *Early Ohio*, *Lee's Favorite*, *Early Harvest*, and *Early Pearl* for early. For main crop *Freeman*, *Nott's Victor*, *Thorburn*, *Rural Blush* for medium; *American Wonder*, *President Lincoln*, *Rural New Yorker No. 2*, *Rochester Favorite*, *O. K. Mammoth*, *Summit*, *White Elephant*, and *White Prize* for late.

A few good varieties, well adapted to the grower's market and soil, are better than a large number, not only because new varieties may turn out to be worthless, but because an unknown sort does not sell as well as an old and favorably known one. Whoever invests largely in a new variety, depending on the seedsmen's catalogues or even neighbors' experience, may be woefully deceived. Every grower should try, however, the more highly recommended new varieties in an inexpensive way, because, having served their day and generation, the old sorts must go and new ones take their places.

POTATOES DISCARDED AS WORTHLESS.

Each year it is found necessary to discard a large number of varieties of potato that are worthless in this state, or at least this part of it. The seedsmen have many of the discarded varieties for sale and it may be of value to know that they are worthless here. All varieties that failed to give an average yield of 100 bushels per acre for three years, and that were below the average in quality or appearance, and that had noticeably bad features, have been discarded. More than as many more are practically worthless here, but we hesitated about blacklisting them until further trial, and because they had qualities which might make them desirable in other localities.

The station has grown in the last three years nearly 400 varieties of potato, only a small proportion of which are worth growing here. The following is the list of those discarded:

Albino,	Hoadley,	Prairie Flower,
Algoma,	Hoffman,	Pride of the West,
Alligator,	Home Comfort,	Prize Taker,
Arizona,	Ionia,	Putnam Beauty,
Badger State,	Jumbo,	Snow Drop,
Ben Harrison,	Koshkonong,	Snow Queen,
Bill Nye,	Late Puritan,	St. Patrick,
Blaine, J. G.,	Leader,	Stray Beauty,
Pink-Eye Peach-blow,	Matchless,	Superior,
Boley N. Spy,	Minister,	Sunlit Star,
Boston,	Mrs. Foraker,	Sylvan,
Carpenter's Seedling,	Negro,	Timpe No. 1,
Chas. Downing,	New Zealand,	Timpe No. 2,
Charter Oak,	Ohio Junior,	Timpe No. 8,
Cream City,	Osceola Mammoth,	Timpe No. 9,
Extra Keeper,	Peach-blow,	Tyrian Purple,
Farmers' Alliance,	Pecan,	West's No. 1,
Geo. H. Price,	Peoples,	White Chief,
Hampden Beauty,	Perfect Peach-blow,	White Star,
Harbinger,	Polaris,	Wixom.

DESCRIPTION OF PROMISING NEW VARIETIES.

Carman.—In shape oblong-oval, somewhat flattened. Skin rough, rose colored. Flesh firm, yellow, dry, and fine grained. The most promising new variety grown this year. A great yielder, though it is inclined to be coarse and prongy. Vines very thrifty and vigorous.

Colossal.—Medium size; shape oblong, flat, a little irregular; skin netted, rose colored; eyes large, shallow, with a little red in them; flesh firm and white. Vines good. Yields well.

Early Everitt.—Size medium or small; shape oblong-oval; skin netted, rose colored; eyes numerous and deep; flesh firm and dry; desirable because of its earliness and productiveness.

Heavy Weight.—Size medium; oval; skin smooth and very light colored; eyes numerous and deep; flesh rather flabby, cloudy white; the potatoes are poor; the redeeming quality of the variety being its productiveness.

Nott's Victor.—Size large; shape oval, regular; skin netted; eyes few, small, shallow; flesh yellow, firm, and dry; very promising.

Prizetaker.—Medium size; oblong; skin rough, straw colored; eyes few and small, deep, with a red tinge; flesh firm, white, dry; plants vigorous.

Quick Return.—A potato of medium size; oval in shape, very regular, fine appearance; skin smooth, very light colored; eyes large, but shallow, few; flesh firm and white. A good variety.

Reeves' Rose.—Small to medium; round, regular; skin netted and scurfy, straw colored; eyes numerous and deep; flesh yellow, firm. A fair variety.

Sir William.—Large; oval; regular; skin netted, a little scurfy, light yellow; eyes few, large, but shallow; flesh yellow and firm. One of the best of the new varieties.

Vick Early Market.—Medium; oval; regular; straw colored; eyes deep, few; flesh firm, white, fine grained, dry. A good early variety.

FERTILIZER EXPERIMENTS.

For several years the station has conducted experiments with fertilizers for potatoes. This season the experiments in that line were considerably extended and a trial was made of various manures for potatoes. Several acres were planted in the fertilizer test, nearly a score of fertilizers being used, and careful attention was given to every detail of the experiment, but the drouth so nearly ruined the crop that positive results of value were few. It was therefore thought best to withhold the results of this year's fertilizer experiments until other experiments along the same line might better prove or disprove the greatly varying results obtained this season.

TREATING SEED POTATOES FOR SCAB.

Last year a thorough examination of corrosive sublimate and Bordeaux mixture as preventives of potato scab was made; the same experiments were repeated this year on even a larger scale, but, unfortunately for the experiment, the season was such that there was but little scab, so that the benefits arising from using the fungicides are not so readily seen. The objects of the experiments were three: to find the best strength of the fungicides; to find the proper length of time for soaking the seed; and to ascertain whether the seed was injured by the different chemical solutions.

The land used for the experiment was a clay loam planted the previous two years to strawberries. The soil was given the same treatment, the potatoes were planted the same, and they were treated in every respect as were the potatoes in the variety tests. The varieties planted were O. K. Mammoth and Rochester Favorite. The seed was not badly affected by the scab, but opportunities for contamination were numerous.

The method of treatment was as follows: Four strengths of the corrosive sublimate solution were used: 1 part of corrosive sublimate to 500 of water, 1 part to 1,000, 1 part to 2,000, and 1 part to 4,000. The solutions were prepared as follows: for the first, 1 ounce of corrosive sublimate to $3\frac{7}{8}$ gallons of water, for the second 1 ounce to $7\frac{3}{4}$ gallons, for the third 1 ounce to $15\frac{1}{2}$ gallons, for the fourth 1 ounce to 31 gallons. The lengths of time were $\frac{1}{2}$ hour, $1\frac{1}{2}$ hours, and 3 hours. After the seed was removed from the solutions it was placed in new paper bags to prevent contamination, which might take place if it were placed in other receptacles. The copper sulphate solutions of the different strengths were prepared by dissolving two ounces of the sulphate in 8, 16, and 32 gallons of water respectively. The Bordeaux mixture was of the usual strength.

Extended remarks upon the experiment this year need not be made, since the matter was very fully treated in the potato bulletin of last year, and no new conclusions of importance could be drawn from this experiment.

It is now a well established fact that potato scab can be controlled easily and cheaply by corrosive sublimate. The remedy is now being used by nearly all large growers, who almost invariably report favorable results from its use. The demand for information concerning the treatment has been so great that a potato scab calendar published last year has had two editions of 3,000 copies each and another edition of 5,000 is now ready for

distribution, and may be had upon application to the secretary of the college.

For fear that some may not have had last year's bulletin or the calendar, the following practical suggestions are given:

Use two ounces of corrosive sublimate to 16 gallons of water. Dissolve the poison in two gallons of hot water first.

Always use earthen, glass, or wooden dishes, never metal.

Tubs, barrels, wooden boxes, and troughs, are most convenient. The potatoes may be placed in a coarse sack and immersed, or a perforated wire or wooden scoop may be used.

The seed may be soaked either before or after it is cut, but preferably before.

Remember that corrosive sublimate is a deadly poison.

LOSS OF WEIGHT IN STORING POTATOES.

It has long been a mooted question among potato growers as to whether it pays to keep potatoes over winter, even when a considerably higher price can be realized. It is a simple question to settle. Last year a small experiment was tried with a view of determining just how much potatoes will shrink in the course of a winter. September 30, 1893, 180 pounds of potatoes were stored in a barrel in a potato basement; March 28, 1894, 179 days from storing, they were weighed and it was found that they had lost eight and three fourths pounds or about five per cent. On May 1 they were again weighed and it was found that there was an additional loss of $6\frac{1}{2}$ per cent making a total loss of $11\frac{1}{2}$ per cent. The tubers were beginning to sprout and were growing soft and flabby. From this on the shrinkage was very rapid; no exact record of it was made, as potatoes are seldom kept after the first of May. It is a simple problem to ascertain whether it pays to store potatoes when there is a shrinkage of from 5 to $11\frac{1}{2}$ per cent. One must take into account also the extra labor, loss from rot and frost, danger from fire, and interest on money, and after all this, that potatoes do not always command a better price in the spring than in the fall. The risks taken certainly show that a considerably higher price must be obtained, if there is to be profit in keeping potatoes over winter. The basement in which the potatoes were kept was perhaps a little warmer than it should have been. Very few cellars are suitable for this purpose. A well ventilated root-house that can be kept at 45° or a little lower, is the only place to keep potatoes properly. In excessively cold weather a good root-house must be well looked after or the temperature will go too low.

SPROUTED *versus* UNSPROUTED SEED POTATOES.

A small experiment was tried this year to find out how much the vitality of potatoes was impaired by allowing them to sprout in the cellar before planting. The results were somewhat surprising and show that the matter of sprouted and unsprouted seed potatoes is one of some importance and deserves considerable attention from potato-growers.

If potatoes are stored in a cellar until late planting time, as a matter of course they will be soft and badly sprouted. Much of the nutritive matter will be used in developing sprouts which will be broken off in planting. The first sprout is always strongest and thriftiest. It sometimes happens

that potatoes are "sprouted" several times before they are planted and each time the vitality is more and more impaired and the result will be weak plants and small tubers. Hence it is necessary to keep potatoes for seed in a very cool place where they will not sprout, or to expose them to light and air where the same thing can as well be accomplished.

The experiment was as follows: During the last of February, two equal lots of potatoes were taken. One lot was left in the cellar; the other was spread on the floor of a dry, well lighted, and moderately warm room. April 20 both lots were planted. The conditions and culture were the same as in the variety tests. The variety was *Early Ohio.* Planted side by side, those that came from unsprouted seed were up first and looked best through the season; they also had less missing hills. September 1 the crop was dug. There was no difference in time of ripening. Briefly summarized, the results were: 313 hills planted with unsprouted potatoes yielded 204 pounds of large potatoes and 36 pounds of small ones. 321 hills of sprouted potatoes yielded 181 pounds of large potatoes and 41 pounds of the small ones. Moreover, there were more ill-shaped tubers among the latter. This is seemingly a small matter, but success in potato-growing does not depend on "luck," and is largely influenced by just such small things. It should not need an experiment to demonstrate the superiority of unsprouted seed; it is but a reasonable conclusion that it is superior.

REMOVING SEED ENDS.

The assertion is often heard, that a better and an earlier crop of potatoes may be grown by removing seed ends of seed potatoes. From one lot the seed ends were removed; the other was planted normally. The result of the experiment agrees with that obtained at this and other stations several times before; namely, that maturity is not hastened and productiveness is not increased by removing seed ends, but on the contrary, figures show an increase in yield for those planted normally because, since the ends were not removed, there was more seed and because the buds at the seed end are stronger than those toward the stem end. Fourteen varieties of potato, in duplicate plots, containing one twentieth of an acre each, were planted and given the same treatment as those in the variety tests. The potatoes, the seed of which was normal, yielded at the rate of 130 bushels of large potatoes and 14 bushels of small ones per acre, while those from which the seed ends were removed yielded at the rate of 125 bushels per acre of large ones and 13 bushels of small ones. The opinion is held by botanists that the seed tip is equal to about one good eye, and there is much to lend color to this view. It is folly therefore to remove the seed tip in planting potatoes. All the more so, since in some varieties other eyes seem to be largely impotent, while those at the seed end are stronger and better. It is worth remembering that varieties of potato have their peculiarities, and that the habit of a variety largely influences considerations of this sort. Without doubt impotent eyes, in some varieties, cause the missing hills that so often can not be accounted for.

SELECTED AND ORDINARY SEED.

The rapidity with which potatoes degenerate can only be known by those who keep a yearly record—a biography of the different varieties. A potato is a precarious thing at best, as it is easily influenced by climate,

soil, and treatment. The kinds popularly esteemed a few years ago, Peachblow, Rose, Snowflake, etc., have been discarded, and new varieties have taken their places. Other vegetables—peas, cabbage, corn, beans—are perpetuated for many years by judicious selection, growing even better oftentimes. Why not the potato? The reasons are, largely, the abnormal conditions under which they are grown; their instability, because of comparatively recent introduction, and the fact that propagation by tubers is not properly reproduction, but simply plant division. Still, it seems that their rapid deterioration might at least be checked by careful selection of seed. This year a small experiment was tried to determine whether a continued selection, year after year, of best potatoes from best hills, might not keep a variety from deteriorating.

The best potatoes and the ordinary potatoes from four varieties were grown under like conditions. It was hardly expected that the first year would show very positive results, yet some gain is shown for the selected seed, both in quality and quantity, there being a marked difference in the appearance of the tubers, in favor of those from the selected seed. Briefly, the results were as follows: 129 hills from selected seed, embracing four varieties, yielded at the rate of 114 bushels per acre; 139 hills from ordinary seed yielded at the rate of 105½ bushels per acre, the tubers of the first, as was before stated, being much superior to those of the latter. The experiment will be continued for several years. The potato crop in this country is now of such vast importance that, however small it may be, anything done to perpetuate a really good variety is a general benefit to the people as a nation.

HEAVY AND LIGHT SEEDING.

"The more seed planted the larger and better the crop," has become almost an axiom with many farmers. Tabulated statements from various stations prove this to be true. Previous bulletins from this station have treated the subject fully and it needs only a word here. The claims of those who advocate the planting of from 30–50 bushels of seed to the acre, however, need to be taken with a grain of allowance. It is true that the yield may be somewhat larger, but the proportion of small potatoes is always greater and, since the cost of seed, the extra work, the fertility of the soil, and various minor matters must be taken into consideration, it is doubtful if such heavy seeding pays. A cursory glance at the conclusions reached by experimenters along this line, shows that most of them favor planting potatoes of medium size or pieces with two or more eyes, from one to two feet apart.

Small experimental plots, with large potatoes and those of medium size, gave the following results the past season: Six varieties, of 215 hills, large seed at the rate of 30 bushels per acre, yielded at the rate of 109.6 bushels of large potatoes per acre, and 16.3 bushels of small ones. The same six varieties with 225 hills, with seed of medium size or small, at the rate of ten bushels per acre, yielded 100.5 bushels per acre of large potatoes and 14 bushels of small ones; the gain per acre from the use of large tubers being less than the increased amount of seed. Taking everything into account, the result is in favor of the medium-size potatoes, with about twenty bushels as the maximum seeding.

TIME FOR PLANTING POTATOES.

Probably no general crop grown depends more on climatic conditions than does the potato. It is an exotic, and the tuber having been abnormally developed at the expense of the rest of the plant, making it a sensitive and variable organism, it stands to reason that its climatic requirements should be carefully looked after, if we are to grow the crop at its best. It seems, too, if the conditions it needs are not supplied, that the plant will more easily degenerate. Much intelligence and care can well be exercised in selecting a proper soil and in planting so that most favorable weather may be had for the growth of the plant. It is of the last that we wish to speak in particular.

In last year's bulletin a rainfall and temperature chart for Michigan was given, in which it was pretty conclusively proved that a gain would be made if farmers planted their potatoes earlier or later than they now do. The matter is brought up in this bulletin because the experience with the drouth during the past summer shows that it will bear being emphasized by repetition. A careful re-study of that chart is recommended. The fact will soon be recognized that the largest and best crops of potatoes are raised by very late or by very early planting. In the northern part of the state only a good late crop can be raised, while in many portions of the southern part the early crop does best. The soil largely determines the proper time to plant, as well as the rainfall. If it retains moisture well an early crop may mature, but if late rains must be depended on the late crop is assuredly best. Plant early potatoes as soon as the young plants will be safe from the frost; plant late ones from the first to the tenth of June, or a little later in the north.

POTATOES FOR NORTHERN MICHIGAN.

The northern part of Michigan has gained a wide-spread reputation for its potatoes. It is greatly favored in soil and climate, its potatoes excel in quality, and it has good facilities for reaching the large markets, while the never-failing demand among consumers and seedsmen for northern grown seed potatoes makes that region one where potatoes should be one of the main crops. The adaptation of the soil and climate to various fruit crops and potatoes can, we believe, be turned to a good account.

Under the most unfavorable conditions of cultivation, the average yield per acre of potatoes, as shown by the last census, is several per cent. higher in the counties north of the pine lands than in the well cultivated parts of southern Michigan.

If the primitive methods used, negligent culture given, and general slackness in growing the crop, were supplanted by systematic and good cultural methods, such as a knowledge of the best varieties, the proper time to plant to avoid the drouths, the best culture to give them, improved implements, and the time and place to market the crop, we believe that that country would become a "potato belt" that could hardly be surpassed. A prosperous future for northern Michigan, as a farming community, can only be assured by growing those crops which are adapted to the region.

PROPAGATING POTATOES BY CUTTINGS.

It is not generally known, or at least thought of, that potatoes can easily be grown from cuttings. The matter is of importance only to those who

desire a large yield of potatoes from a very limited amount of seed, as is the case when one buys a few pounds of a new variety of potato at an enormous price, or when one has discovered, and wishes to grow, a superior seedling.

The method of procedure is as follows: The potatoes are cut into halves and planted cut side down in a hot-bed where the temperature can be maintained at 60 to 70 degrees. When the sprouts are three or four inches high they should be cut off about an inch from the surface of the potato. Place the cuttings in a box of pure sand, water them well, and shade them for a few days, keeping them in the hot bed where they will have bottom heat. In about three weeks they will have rooted, when they should be transplanted into small pots or boxes of fairly rich soil, and kept in a mild temperature until large enough to plant in the field. The same process may be continued time after time, as the potatoes will continue to sprout until perhaps a dozen shoots are taken from each eye. It must be remembered that the plants thus started are weaklings and need the very best of care. At the station this year we grew 111½ pounds of Carman potatoes from four small potatoes (less than one pound of seed), and this in an adverse season.

SEEDLING POTATOES.

The potato is one of the easiest and most constant subjects for the plant improver. Since propagation by tuber is simply plant division, and not really reproduction, it naturally follows that after long cultivation a variety of potato becomes weak in constitution and finally worthless. To-day, hardly one of the popular sorts of fifteen years ago is grown. The production of new varieties is an absolute necessity, and of widespread importance.

In cross-breeding potatoes, the pollen must be transferred from the flower of one variety to the stigma of the flower of another. The stamens of the flower to be used as the female should be cut away (it is best done with a pair of small scissors), before the pollen in them is ripe. To prevent insects from carrying pollen from other flowers, the one fertilized should be covered with a small paper bag. When the pollen is ripe take a flower from the stalk of the male parent and shake the dry, powdery pollen on the mucous surface of the stigma of the flower to be fertilized. Cut off all flowers on the plant that are not wanted. When the potato balls are ripe the seed may be obtained by mashing them and washing out the pulp. Sow them indoors, as you would tomato seed, and when a few inches high transplant into a hot-bed or flats in the house, and then to the open field. A great number of small potatoes will be the result, and these should be planted in the ordinary way, each year saving only the best. In making a selection of a seedling variety you wish to perpetuate, it is best to have in mind the characteristics desired and then make selections accordingly. It will take three or four years, at least, with close selection, to fully establish a new variety. Intelligence, long-continued carefulness, and perseverance are required to originate a good variety of potato.

GENERAL NOTES.

Potatoes often fail to come up because they are scalded when planted; drills should never be made long before the seed is to be planted. When exposed a few hours to a hot sun the earth becomes so dry and heated

that when it comes in contact with the potato seed it dries them out and prevents many of them from coming up. The greatest hindrance to successful potato-growing is the hot, dry weather, and every means should be resorted to to retain the moisture.

In selecting a variety of potato, such qualities as productiveness, healthfulness, regularity of shape, and uniformity of size should influence the choice, but the grower should also take into consideration the fitness of the potato for his market. Most markets prefer a somewhat elongated, oval potato, with an even surface, few and shallow eyes, and a smooth, white skin. Others prefer an oval potato and a reddish skin.

The potato rot (*Phytophthora infestans*) is a disease caused by a fungus which first attacks the leaves and then passes into the potato. The tubers may rot before digging, or the greatest damage may be done after the crop is stored. The conditions are favorable for the disease when the atmosphere is moist and warm, and when there is an abundance of decaying vegetable matter in the soil. A loose, porous soil is less likely to furnish proper conditions for the disease than a heavy one which retains moisture and does not admit air. The potatoes when planted should be free from the disease. The treatment with corrosive sublimate or Bordeaux mixture, used for the scab, will aid in freeing the seed from the fungus. The thorough spraying of the vines with Bordeaux mixture every two weeks after July 1 will generally prevent the appearance of the blight and the resulting rot. If the vines have been badly affected, to save the crop remove the potatoes as soon as possible, dry them thoroughly, and store in a cool, dry place. If the rot is bad, from time to time the potatoes should be sorted. Avoid a warm, close cellar and deep bins. It is said that lime thinly dusted on the tubers will destroy adhering germs. It is a wise precaution to burn all affected vines to prevent the spread of the disease the following year.

There are a large number of machines for planting and digging potatoes, and while there is not one that will work perfectly under all circumstances, nor even do the work as well in any case as can be done by hand, yet the better class of both planters and diggers are to be recommended to large growers. Digging or planting by hand will cost five or six times as much, and when labor is scarce machines of some kind are a necessity.

In digging, avoid exposing the potatoes to light any longer than is absolutely necessary. As soon as dry put them in shallow piles where they may be covered. A few hours of air and sunshine changes their natural color and destroys their fine flavor. If the potatoes are to be kept over winter it is a good plan to cover them lightly with earth in the field and allow them to remain for a few weeks, so that those that are inclined to rot may be separated from them before they are finally stored.

Potato bugs do more damage to potatoes than all other enemies combined. A little negligence and the crop is destroyed. As to remedies there is but little choice. Paris green is the great exterminator, but as to methods of applying the remedy there is considerable choice. If the Paris green is mixed with water, or put on in the old-fashion way with flour, lime, or plaster, it costs several dollars per acre to keep down the potato bugs. The station uses an insect gun and finds it a cheap and efficient way of applying the poisons. We believe the cost is not more than one half as much as it is when the older methods are used.

SUMMARY.

1. Potatoes deteriorate rapidly under ordinary cultivation, and it is necessary to frequently change seed to keep them in their pristine purity and excellence.

2. Experience with the severe drouth well demonstrates the value of continual cultivation in a dry season.

3. The following varieties of potato are recommended for Michigan: *June Eating, Early Norther, Early Oxford, Early Ohio, Lee's Favorite, Early Harvest, Early Pearl, Freeman, Nott's Victor, Thorburn, Rural Blush, American Wonder, President Lincoln, Rural New Yorker No. 2, Rochester Favorite, O. K. Mammoth, Summit, White Elephant, and White Prize.*

4. The following are promising new varieties: *Carman, Colossal, Early Everitt, Heavy Weight, Nott's Victor, Prizetaker, Quick Return, Sir William, Vick Early Market.*

5. It is now well established that potato scab can be controlled easily and cheaply by the corrosive sublimate treatment.

6. Potatoes kept over winter lose much in weight. One hundred and eighty pounds of potatoes stored in a potato basement September 30, 1893, lost 11½ per cent. in weight by May 1, 1894.

7. The vitality of potatoes is impaired by keeping them where they can sprout before planting. Three hundred and thirteen hills from unsprouted seed yielded 240 pounds of potatoes, while 321 hills, using sprouted seed, yielded only 221 pounds of potatoes.

8. Fourteen varieties of potato were planted, to learn the effect of removing the seed ends of seed potatoes. The potato planted normally yielded at the rate of 140 bushels per acre. Those from which the seed ends were removed yielded at the rate of 138 bushels per acre. In the matter of earliness there was no difference.

9. An experiment, tried to determine whether a selection, year after year, of the best potatoes for seed might not keep a variety from deteriorating, seems to show from the first year's results that there is something to be gained by such selection. The yield was larger and appearance of the tubers better from the selected seed potatoes.

10. An experiment with heavy and light planting of seed potatoes agrees with the concensus of opinion of other experimenters; that is, that a medium quantity of seed per acre is best.

11. Indications are quite conclusive that a gain would be made if farmers planted their potatoes earlier or later than they now do.

12. Potato-growers who desire a large yield of potatoes from a very limited amount of seed, may easily increase the yield by growing potatoes from cuttings.

13. If intelligently, carefully, and perseveringly attempted, farmers may originate new varieties of potato.

14. Potatoes often fail to come up because the seed is scalded by being planted in open drills and left exposed for a few hours to the sun and wind.

15. In selecting a variety of potato, productiveness, healthfulness, uniformity of shape and size, adaptability to soil, and the market to be supplied, should influence the choice.

16. Potato rot (*Phytophthora infestans*) may be controlled, somewhat, by preventive methods, treating the seed with corrosive sublimate or Bordeaux mixture, and by spraying the vines with Bordeaux mixture.

VEGETABLE NOVELTIES AND NOTIONS.

BY L. R. TAFT, H. P. GLADDEN, AND U. P. HEDRICK.

Bulletin No. 120.

As in past years, we again present the results obtained from the trials of the new varieties of vegetables sent out by the seedsmen.

The number of varieties sent out each season is on the increase, and, while in many cases they are of pronounced merit, in too many cases the dealer has not been fair with the public, as they differ little, if any, from some old sort, and are not even worthy of being considered distinct strains.

We have endeavored to impartially point out the merits of the new sorts as compared with the standard varieties.

BUSH BEANS.

Twenty-six varieties of bush bean were planted June 6. The dry, hot weather, coming on soon after germination, so affected the growth and yield of the different sorts that little of value could be gained by a comparison of the results obtained.

The following are new sorts:

Flageolet Victoria, Henderson.—It is a late variety. The plants are of very large growth and productive. The pods are green, six to seven inches long, one half inch wide, and flat, stringless and of excellent quality. A promising late market variety.

Marvel of Paris, Thorburn.—Plants are of good growth and quite productive. Pods green, long, straight, fleshy, but somewhat stringy.

Nettle-leaved Bagnolet, Thorburn.—Plants of very vigorous and healthy growth and moderately productive. The pods are green, 5 to 6 inches long, flat, and of good quality. The variety is excellent as a shell bean.

Thorburn Market, Thorburn.—This is a very early and a rather small-growing variety. It was so affected by the drouth and rust that few pods were borne by the plants.

Stringless Green Pod, Burpee.—Plants are of medium growth and fairly productive. The pods are green, short, round, thick, and of excellent quality.

Of the older sorts, Cylinder Black Wax, Butter Wax, and Mammoth Wax would make an excellent selection of the yellow-podded varieties.

The green-podded varieties, Red Valentine, Shah, and Flageolet Victoria would give good satisfaction.

POLE BEANS.

Fifteen varieties of pole bean were planted June 12.

Black Lima, Burpee.—The uncertainty of having the Limas mature before the frost kills the plants is a serious drawback to their cultivation in this section. The Black Lima is almost sure to mature a fair crop before frost comes. The plant is a good grower and an abundant bearer and the beans are of excellent quality. If one desires a supply of this delicious vegetable, this variety should be the one selected.

Golden Champion, Ferry.—This is a snap pole bean. It was the earliest of its class to mature edible pods. The plants are not of large growth and but moderately productive. The pods are of bright yellow color, stringless, and of good quality. As an early pole snap bean, it is the best grown here.

Golden Cluster, Ferry.—The plants are very strong-growing and enormously productive. The pods are a rich, golden yellow color, and the flesh thick, tender, and of best quality. It matures three to four weeks later than Golden Champion. As a late snap bean and as a variety to succeed the bush sorts, Golden Cluster is excelled by none. It should be planted in every garden.

Sunshine Wax, Burpee.—Similar to Golden Cluster.

Kentucky Wonder, Ferry.—This is one of the best green-podded varieties. The pods are large, thick, and of good quality. A very productive sort.

Willow Leaf, Burpee. Does not mature beans before time of frost. Its peculiar and distinctive foliage makes it desirable as an ornamental plant.

BEET.

Twelve varieties of beet were planted May 28.

Columbia, Burpee.—This comparatively new sort is very early in maturing. The roots are of regular form, flesh solid, handsome in appearance, and of fine quality. A very desirable early variety.

Dirigo, U.S. Dept. Ag.—An excellent rather late-maturing variety. Root flat, top round, tapering slightly, smooth and regular. Its good form, color of flesh, and quality make it a desirable sort for general growing.

Electric, Henderson.—This new sort has a small top. The roots are very large in proportion to tops, turnip-shape with a slender tap-root. The color and quality of the flesh is good and it is also a very early variety. Valuable.

Red Carmine, Salzer.—The smooth, regular form of the root, its handsome color and excellent quality, combined with its early maturity, make this a very desirable sort for the garden.

Eclipse, as an early sort; *Half-long Blood*, for medium season, and *Long Blood* for winter storing, of the older and better known varieties, still have a place in the home garden or for market purposes.

CABBAGE.

Preparations were made for a thorough test of the many new cabbages offered by the seedsmen. Fifty-one varieties, of which only a few were old or standard sorts, were planted. The drouth came just as the early varie-

ties were getting ready to head, and just after the late ones were set in the field. Notwithstanding the drouth, some of the early varieties made a very fair showing, but the late cabbages failed entirely, ten or twelve varieties failing to show even one head. A few did fairly well, and of these, and of the earlier sorts, the following notes are given.

St. John's Day Drumhead.—Plants small, stem short and stout; foliage deep green, glaucous, leaves few, small, truncate at apex, border undulate, veins conspicuous; head round, slightly flattened, small, compact. The type is a distinct one, though the heads vary much. A poor header, valuable only on account of its extreme earliness.

Peerless.—Plants medium size, leaves small, oval, border undulate, apex reflexed; stem short; heads medium size to small, roundish flattened; leaves so loose that heads are not well defined. A poor header, and so variable that the variety is not valuable.

Burpee's Safe Crop.—Plants medium size; stem short, leaves medium size, spoon-shape, undulate; heads large, flat, very compact, well defined. An excellent midsummer variety, being a sure header and producing a very attractive head. The type is that of Henderson's Early Summer. When grown late an equally good winter variety.

Eclipse.—Plants small; stem short and slender; outer leaves smooth, flat, leathery, light green, erect; head conical, rounded apex. A strain of Wakefield, which it resembles very much; not so desirable as that variety, however.

Ideal.—Plants medium size, stem short; leaves large, oval, borders plain; heads small, flat, not well defined. A good producer but the heads are small. Type, that of Henderson's Early Summer.

Lightning.—Plants small, stem short and slender; leaves oval, smooth, plain borders, leathery, erect. Heads large, compact, well defined. A very early variety resembling Wakefield; its manner of growth is such that the plants can be placed very close to each other.

Midsummer.—Plants large, stem short and thick; leaves large, smooth, borders undulating; heads large, flat, very compact, well defined. The best midsummer variety grown. Almost identical with Burpee's Safe Crop; it is a better strain, however, as a summer cabbage.

Washington Wakefield.—An excellent strain of Jersey Wakefield. Very early, heads large, type well fixed.

All Head.—(Burpee's.) A good strain of Early Summer, but it is a little earlier and a little larger than that variety It is a more compact grower, hence more can be planted to the acre. It is said to be a good winter cabbage, though we did not find it so, perhaps because of the drouth.

Autumn King.—Plants medium size, stalk short; foliage compact, dark green, crinkled, with purple tinge; heads large, flat, broad, thick, solid. Heads are very good, but this year only a small percentage of them formed. The purple tinge of its crinkled leaves and somewhat peculiar manner of growth seems to make the type distinct.

World Beater.—This variety is, without doubt, the same as Autumn King.

CAULIFLOWER.

Contrary to what would be expected, in so dry a season, the cauliflowers did well this year. Eleven varieties were tested. The plants were started in the forcing house March 27, transplanted in hot beds in May, and set

in the field June 25. Owing to the drouth, which began about that time, they made but little start until August, after which the growth was remarkable, and a better crop of cauliflowers could rarely be found. The soil was a wet black muck, very suitable for the crop. The cultivation given was that which is ordinarily given cabbages, and the results obtained refute the prevailing idea that cauliflowers are far more difficult to grow than cabbages. Aside from being a little more particular in regard to soil, and requiring a little more attention at heading time, they are not, and cauliflowers should be far more extensively grown, especially by small gardeners and farmers. The following varieties were tested.

Burpee's Best.—An improved strain of Early Erfurt. Stalk short; foliage medium size, very compact; heads large, globular, solid, easily blanched, pure glistening white. A few days later than Early Erfurt. A sure header and one that rarely "breaks." One of the best varieties tested this year.

Danish Snowball.—Grown side by side with Early Erfurt, and in appearance of plant the two are identical. The former can be told, however, by the pink tinge of the head, especially when young. In season and in productiveness it is about the same. The heads are more irregular than are those of the Erfurt, and the plants show a greater tendency to "break."

Early Dwarf Erfurt.—For many years considered the standard early variety. Still reliable, though there are several improved strains under other names that are better. Stalk short and stout; leaves small, upright, spoon-shape, compact, light green; heads large, globular, regular, flowerlets small, very white. A sure header and is probably suited to more different soils than any other variety.

Early Favorite.—Another, though very inferior, strain of Early Erfurt. Nearly every head broke. General appearance of plant like Erfurt. Heads round, somewhat flattened, loose, rather coarse, very irregular. A poor variety.

Giant Purple.—Plants of enormous size, leaves large, glaucous green, spreading; stalks large, slender; heads flat, loose, purple in color, flowerlets small; does not head well, and has a strong tendency to break. A variety of broccoli sold as a cauliflower.

Half Early French.—Plants very large, stalky; leaves large, spreading; heads medium size, flat, compact, flowerlets small; color not good; tends to "break" badly. Introduced from France. Not to be recommended.

Landreth's First.—A strain of Early Erfurt which it resembles very much in appearance. A few days earlier. Type variable. "Breaks" badly, unproductive.

Model.—Plants dwarf; stalk short; leaves small, upright in growth, spoon-shape, glaucous green; heads large, globular, compact, very regular, pure white; season just before Erfurt; sure header. One of the best varieties grown this year.

Snowball, (Henderson).—A very early strain of Early Erfurt. Plants very small, round, pure white, compact, flowerlets small; foliage like that of Erfurt. A reliable header, a good producer; for very early the best variety tested, it being several days earlier than Erfurt.

Gilt Edge, (Thorburn).—A strain of Snowball, from which it differs in being a larger plant, having larger heads which are not so compact and attractive, and not so reliable in heading; a few days later.

CAULIFLOWER, TESTS OF VARIETIES.

Variety.	Seedsman.	No. of plants.	No. of heads.	Days to maturity.	Average weight of heads.	Average diameter of heads.
Burpee's Best	Burpee	30	25	175	3 3-4 lbs.	6 3-4
Danish Snowball	Vaughan	45	38	171	3 4-5 "	7 1-2
Early Dwarf Erfurt	Landreth	30	24	172	3 2-3 "	7 1-2
Early Favorite	Ferry	30	8	174	3 1-2 "	7 2-3
Giant Purple	Childs	35	4	190	4 "	8 1-2
Gilt Edge (Thorburn)	Thorburn	30	28	175	3 3-4 "	7
Half Early French	Landreth	30	16	178	2 4-5 "	7
Landreth's First	"	30	15	174	3 1-5 "	6 1-2
Model	N. B. & G. Co.	60	56	170	3 6-7 "	7
Snowball (Henderson)	Agr'l Dept.	30	22	168	3 2-3 "	6 3-4

CELERY.

The celery seed was sown in boxes in the forcing house April 21. The young plants were transplanted to flats May 23. The final setting out was done June 26. The place selected for the celery planting was originally a small swamp. The soil was black, loose, of considerable depth, and in a good state of fertility. The one thing lacking to make it an excellent place for the crop was moisture. The plot was so situated that with a few lengths of hose the ends of the rows of a considerable portion of the patch could be reached. The plan suggested itself of trying sub-irrigation as a means of supplying the plants with the moisture needed for their growth. The plants were set six to eight inches apart in rows six feet distant. A line of two-inch drain tile was put in the center of each alternate row of plants. The tile were placed at a slight incline, and about six inches beneath the surface. A space of one eighth to one fourth inch should be left between the joints for the water to pass out. One end of the line of tile should have an opening at the surface to enter the hose. Our rows were six rods long and for that distance water would flow to the further end and moisten quite evenly all the soil. If one has a head of water near at hand this is a very convenient way to irrigate a crop. If this source of water is not available, a large tank or a number of barrels can be driven along the end with a line of hose to connect with the tile. The laying of the line is not a difficult job and, once in place, the hose can be entered and the water allowed to run without further attention until the supply is exhausted or a sufficient amount applied. The experiment of watering celery by sub-irrigation was entirely a success, and a good crop, excellent in quality and free from rust, was grown during the past season of drouth.

CUCUMBERS.

The cucumbers were planted June 6–7. The season has been a most unfavorable one for their growth and development.

Siberian, Vaughan.—Was first to grow fruits of pickling size, and also first to produce cucumbers for slicing. The plants are very productive. Valuable as an early variety.

Everbearing, Thorburn.—A few days later than Siberian, and the plants are scarcely as productive, though the cucumbers are considerably larger in size.

Green Prolific, Vaughan.—One of the earliest and best varieties to produce fruits for slicing.

Westfield Chicago Pickle, Vaughan.—The plants are strong-growing and productive. One of the most desirable sorts for general pickling purposes.

Giant Pera, Vaughan.—The earliest of the large-fruiting sorts to reach edible maturity. The cucumbers are large, of good form, and excellent quality. The flesh is very solid and but few seeds are present. A desirable variety.

White Spine, Burpee.—This is perhaps the best general-purpose variety for the home garden.

Parisian Prolific, Ferry.—The plants are of strong growth and very productive. The fruits are long, slender, and make excellent pickles.

Albino, Ferry.—This is a comparatively new sort. If one desires a white-skin cucumber this variety would be an excellent one to select for the purpose.

Japanese Climbing, Vaughan.—This variety climbs readily if poles or a trellis is provided. The cucumbers are 5–7 inches long, 2 inches in diameter, and very regular in form. The flavor of the fruit is quite distinct from the ordinary cucumber. The variety is quite productive, continues to produce new cucumbers until the vines are killed by frost. Should regard it as an acquisition.

As varieties to grow for pickling purposes, Siberian, Westfield, and Parisian Prolific would make an excellent selection. For table use, White Spine, Green Prolific, and Long Green, with Japanese Climbing and Albino as novelties, would prove satisfactory.

ONIONS.

Fourteen varieties of onion were tested this year, of which descriptions of several of the newer sorts are given. A quantity of Prizetaker onions were transplanted with very satisfactory results. The method is to be recommended where extensive truck-farming is carried on, or where a superior quality of onion is desired. General truck-growers may find the method profitable, since, at present prices, only the grower who succeeds in raising a very large number of bushels of first-class onions to the acre can hope to grow the crop profitably. None of the new varieties are equal to the old standard kinds, and for the main crop, Red Wethersfield, Yellow Danvers, and Southport White Globe are still to be recommended. In the northern part of the state, or on a cold, mucky soil, Extra Early Red succeeds best, and because of its milder flavor it is sometimes preferred in other localities.

Early California.—Bulbs oblate, spherical; outer skin brownish red, second skin thin, glassy, purple; inner coats white, greenish at the neck; bulbs firm; fair yielder; season early; foliage small. Differs from Red Wethersfield in being smaller, more spherical, earlier, and less productive.

Oregon Danvers.—A strain of Yellow Danvers, which it very much resembles; it is lighter in color, more spherical, and a little later.

Salzer's King of the Earliest.—A type of the Red Wethersfield; it is smaller, nearer spherical, earlier, and milder in flavor; quite irregular in shape.

Southport Early Red Globe.—A large, red, spherical onion said to be earlier than Southport Red Globe; this year it ripened with Yellow Danvers; it is a promising variety of the Red Globe type; a good yielder.

Southport White Globe.—A variety very similar to the other in shape and quality; it is a pure white, said to be an enormous cropper, though that

quality was not noticeable this year. Too late to grow except in the southern part of the state.

Michigan Danvers.—A strain of Yellow Danvers, said to be particularly suited to Michigan soils. No difference between the two could be noticed except that the Michigan Danvers was a little more spherical and slightly lighter in color.

Red Victoria.—A strain of White Victoria from which it differs only in color; its flesh is juicy, mild, and as white as that of the White Victoria. Both of these onions are well worth growing; they are globular in shape; of large size and excellent quality; rather late; need good care.

PEAS.

Forty varieties of pea, mostly those introduced during the last few years, of which ten were this year's novelties, were grown. Several of the older varieties were used as standards with which the newer kinds were compared. The objects in view were to determine the relative merits of the peas for the market gardener and the farmer; to ascertain what varieties were synonymous; and to observe the behavior of the various kinds under cultivation with the view of obtaining hints for their further improvement.

The peas were planted in double rows, 3½ feet apart, 200 peas of each variety being planted. The planting was done the 11th of May. Unfortunately a cold rain set in and continued for several days, owing to which many of the seed, especially of the late and wrinkled varieties, rotted, so that the percentage of germination was extremely small. In a few cases none of the seed grew, notably four of the ten novelties.

Good growing weather followed, and conditions were favorable for a test of the early varieties. About the middle of June a drouth began which lasted until the end of July. The midsummer and late varieties suffered much from the drouth and the results obtained may not do them justice, though they will certainly indicate the value of the varieties for a dry season. The counting and weighing was done with the greatest care possible and the data given in the table indicate pretty correctly the relative merits of the different varieties; attention is especially called to the table for facts regarding maturity, productiveness, and quality.

Though a great number of new peas are being introduced yearly during the last two or three years, none have been put upon the market that are likely to supersede the so-called standard sorts. Most of the newly introduced smooth, white and blue varieties, are identical with older sorts, or differ but little from them.

Special attention is called to the edible-podded peas. Market gardeners, farmers, and consumers pay too little attention to this class of peas. They deserve to be more generally grown. If used when young enough to be free from the membranous lining, from strings, and to be brittle and succulent, they are excellent, especially for family use. There are several varieties listed in the seed catalogues, of which the best are: Melting Sugar, Tall Sugar, Mammoth Sugar, and Dwarf Sugar. The first three are much alike and of equal merit, the preference, if any, being for the Mammoth Sugar. The last variety differs from the first three mostly in being a dwarf grower.

Below is a brief description of several of the newer varieties of pea:

Paragon.—A late, or medium late, half-dwarf pea, of the smooth, blue, wrinkled type. This year a failure.

Queen.—A half-dwarf pea of the green wrinkled sort, foliage vigorous, sturdy, branching freely so that it needs to be planted thinly; pods large, curved, largely borne in pairs, good color; peas good size, round, excellent quality; season medium. A very promising new variety.

Sapphire.—A vigorous, half-dwarf variety, with rich, green foliage, large leaves and stipules; pods long, curved, rather unevenly filled, not ripening at the same time; season second early; a good producer; for a smooth, blue variety it is excellent in quality; much like Alaska, Blue Beauty, and Bergen Fleetwing.

Station.—Vines vigorous, 2 to 3 feet in height, light green. Pods short, broad, curved, many of them small; unproductive; peas medium size and quality; season early; seed smooth, white. Judging from this year's trial, not desirable.

Sterling.—One of the blue wrinkled varieties; vines unthrifty and much affected by the drouth; pods long, slender, recurved, not evenly nor well filled; peas of fair size and good flavor. Not particularly desirable.

Sunol.—An early strain of the smooth white varieties. It hardly differs from the old First and Best. As grown this year it was a day or two earlier, but far less productive.

VARIETY TEST OF PEAS.

Variety.	Seedsman.	Date of edible maturity.	End of maturity.	Days to maturity.	Number peas per pod.	Per cent peas to total weight.
Alaska	Ferry	June 26	July 7	46	5.	50
American Champion	Henderson	July 8	" 19	58		
Bergen American Wonder	College	June 27	" 6	47	4.4	52.5
Bergen Fleetwing	Gregory	" 25	" 3	45	5.7	48.
Duke of Albany	Henderson	July 7	" 17	57	5.1	50.
Blue Beauty	Buist	June 27		47		
Early May	Saltzer	July 1	July 14	51	4.6	58.
Early Prize	Maule	June 27	" 9	47	4.	58.
Echo	Burpee	July 10	" 26	60		
Exonian	Thorburn	June 28	" 6	48	4.1	56.
Fillbasket	Henderson	July 14	" 23	64	4.6	57.
Heroine	Vaughan	" 9	" 22	59	5.	52.
Juno	Henderson	" 10	" 19	60	5.2	52.
Mammoth S.	Maule	" 1	" 24	51		
Market Garden	Henderson	" 14	" 26	64		
McLean's Little Gem	Ferry	June 28	" 9	48	5.1	56.7
Melting Sugar	"	July 9	" 18	59	5.	45.
Morning Star	Childs	June 26	" 13	46	5.	48.8
Paragon	Maule	July 6	" 17	56	3.5	50.
Paragon	Vaughan	" 13	" 24	63		
Perpetual	Maule	" 17		67		
Premium Gem	Ferry	June 28	July 9	48		56.9
Pride of the Market	Henderson	July 10	" 20	60		
Profusion	Burpee	" 7	" 16	57	3.6	56.
Queen	Henderson	" 19		69		
Sapphire	N. B. & G. Co.	" 1	July 11	51	5.	53.
Shropshire Hero		" 6	" 19	56	6.5	56.
Station	Thorburn	June 26	" 5	46	4.5	62.
Sterling	Dept. Agr'l.	July 6	" 17	56		56.
Stratagem	Ferry	" 9	" 19	59	3.4	44.
Sunol	Vaughan	June 26	" 5	46	5.2	53.
Yorkshire Hero	Ferry	July 9	" 20	59		
Duke of Fife	Thorburn	" 18	" 28	68		
Pride of the Harvest		" 7	" 18	57	6.2	50.

SWEET CORN.

The sweet corn suffered more from the drouth, perhaps, than any of the other vegetables. All varieties had the same chance, however, and allowance can be made for the drouth. The corn was planted the first of June; the growing season was good until the middle of June, when the drouth prevented further growth until August; the corn did not recover and the low yield is thus accounted for. Several new varieties were tried, some of which are promising. The table shows the results obtained very accurately. For a list of varieties for the various seasons the following are recommended: First early—*Early Vermont*, *White Cob Cory*, *First of All*. Second early—*Early Champion*, *Leet's Early*. Medium—*Hickox Hybrid*, *Landreth*. Late—*Country Gentleman*, *Zigzag*, *Stowell's Evergreen*. The following are descriptions of the more promising new varieties.

Fordhook.—An extra-early corn maturing at the same time as Cory. Ears large, eight-rowed, small cob; grain deep, very white; quality excellent. This year a failure because of the many deformed and irregular ears. To be recommended for the extra-large size of the good ears, excellent quality, and its freedom from smut.

Honey Dew.—A second-early variety. Ears large, eight- to ten-rowed, kernels medium size, corn and cob white. The type is not well fixed, and the corn is a poor yielder. Its appearance is good and the quality is excellent.

Portland.—The most promising new variety grown this year. Stalk and foliage heavy, suckers but little; ears large, tapering, ten to twelve rowed; kernels large, broad, rounded; corn and cob pure white; quality good, looks well and yields well. It grew and looked much like Bonanza, —a better variety, however.

California.—Stalks tall, slender; foliage good; ears large, twelve-rowed; kernels small, deeper than broad; cobs not well filled; flavor poor; unproductive; not promising; season medium.

Silver Coin.—Stalks very tall, slender, long-jointed; ears long, slender, fourteen- to sixteen-rowed; kernels deeper than broad; quality good; unproductive; season about that of Stowell's Evergreen. Not a very promising variety.

Golden Nugget.—A complete failure this year. Not enough ears filled for testing the merits of the corn.

VARIETY TESTS OF SWEET CORN.

Variety.	Seedsman.	Days to maturity.	No. days corn was edible.	Average height of stalks.	Average length of ears.	Average weight of ears.	No. of ears to acre.
Black Mexican	Ferry	85	9	5 ft.,	6 in.	4 oz.	13,740
Bonanza	Gregory	79	14	4 " 8 in.	5 "	3 3-4 "	9,634
California	Childs	88	12	4 " 6 "	5 "	4 "	10,668
Country Gentleman	Henderson	87	17	5 "	5 1-2 "	4 "	15,409
Early Champion	Vaughan	75	15	5 "	6 "	5 "	10,472
Everbearing	Maule	85	15	5 "	5 3-4 "	4 3-4 "	11,785
First of All	Burpee	72	13	3 " 10 "	5 "	3 1-2 "	11,479
Fordhook	"	74	11	3 " 10 "	4 3-4 "	3 1-2 "	14,505
Golden Nugget	Gregory	76	13	5 "	5 3-4 "	4 1-4 "	14,224
Hickox Hybrid	Ferry	79	13	5 "	6 "	6 2-3 "	11,063
Honey Dew	Childs	76	15	4 3-4 "	6 "	5 "	12,629
Landreth	Landreth	87	11	5 " 2 "	5 "	5 1-2 "	11,684
Leet's Early	Ferry	76	15	4 " 2 "	6 1-3 "	7 1-2 "	13,335
Old Colony		87	11	4 " 8 "	6 "	6 1-2 "	14,224
Portland	N. B. & G. Co.	76	11	5 "	5 1-4 "	4 4-5 "	12,801
Silver Coin	Ferry	85	16	4 " 6 "	6 3-4 "	6 1-2 "	8,805
Stowell	"	85	19	5 " 10 "	7 1-4 "	7 "	12,678
Vermont	Vaughan	73	12	4 "	5 "	3 1-2 "	13,650
White Cob	Ferry	73	16	4 1-2 "	5 1-4 "	4 4-5 "	15,662
Zigzag	N. B. & G. Co.	83	20	4 " 10 "	4 1-2 "	3 1-4 "	9,779

TOMATOES.

One hundred and five varieties were sown in the forcing house April 1. When the plants were two inches high they were reset in flats, plenty of space being allowed for them to grow stout and stocky. The plot provided for the tomato patch was a rather light sandy loam. It had previously received a good dressing of well-composted stable manure. The ground was thoroughly prepared and the plants were set out June 6–7. The rows were five feet apart and the distance between the plants in the row was four feet.

A wire trellis, made by driving boards, six inches wide and about three and one half feet long, firmly into the ground between every third or fourth plant, and fastening two wires on each side of the board, one about a foot and the other two feet from the ground, was provided. This trellis is cheap, easily put up, and serves its purpose well in keeping the tomatoes off the ground, promoting the growth and vigor of the plants, and exposing more readily the fruit to the sunlight. It is, however, doubtful if it would pay to trellis a large planting of tomatoes grown for market purposes. The increased yield would scarcely pay for the extra labor and expense of the trellis.

TOMATO ROT.

This troublesome disease often causes much loss to the tomato crop. Last season, when the tomatoes had grown to the size of hickory nuts, the plants were given a thorough spraying with Bordeaux mixture. Three weeks later the application was repeated. Very little rot was found on the

plants sprayed, while on plants purposely left untreated many diseased fruits were noticed. The season being a remarkably dry one, the rot did not do the usual amount of damage to the crop. The results seem to show conclusively that the disease can be kept in check by the use of Bordeaux, if treatment is begun early in the season.

In the table below are given the time of ripening and the yield of a few of the older and better sorts, and of the new varieties grown. Six plants of each variety were grown. The yield is divided into three periods so that the early productiveness, often an important point, can be noted. The average weight of ripe fruit shows the comparative size of the different varieties. In the last column is given the weight of green fruit remaining on the plants at the time of killing by frost, October 13.

TABLE OF VARIETIES OF TOMATO—EARLINESS AND YIELD.

Variety.	Seedsman.	Date of first ripe fruit.	Yield of ripe fruit in August.		Yield of ripe fruit Sept. 1-10.		Yield of ripe fruit Sept. 11-Oct. 3.		Total weight of ripe fruit.		Total number of ripe fruits.	Average weight of ripe fruit.	Weight of green fruit on vine after the crop was picked.	
			lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.		oz.	lbs.	oz.
Victor	Neuman	Aug. 13.	7	11	31	6	13	14	52	15	268	3.16	40	2
Advance	Burpee	" 8.	15	7	34	8	2	11	52	10	471	1.79	46	2
Acme	Gregory	" 21.	2	13	21	6	5	2	29	5	156	3.	36	12
Ignotum	College	" 15.	5	7	37	11	11	2	54	4	178	4.83	66	---
Potato Leaf	Livingston	" 22.	6	7	22	12	1	14	31	1	159	3.12	73	2
Earliest	Vaughan	" 1.	24	11	22	9	5	----	52	4	460	1.83	41	4
Atlantic	Johnson & Stokes	" 7.	17	4	17	9	1	5	36	2	214	2.7	29	4
Earliest of All	Salzer	" 4.	7	5	5	12	3	3	16	4	132	1.96	20	4
Ponderosa	Henderson	" 27.	----	----	18	7	1	14	20	5	43	7.53	45	---
Early Ruby	Henderson	" 10.	9	13	27	----	5	12	42	9	207	3.29	28	8
Dwarf Champion	Harris	" 18.	9	----	23	12	3	9	36	5	175	3.38	34	8
Money Maker	Landreth	" 17.	6	2	33	7	3	3	42	12	214	3.19	33	---
Ignotum	Berthoud	" 17.	8	2	15	12	2	5	26	3	151	2.97	56	---
Potato-leaved Ignotum.	College	Sept. 1.	----	----	23	7	12	9	46	----	111	6.63	50	8
Buckeye State	Livingston	Aug. 30.	----	----	17	4	10	14	28	2	132	3.4	96	12
Terra Cotta	Thorburn	" 15.	5	6	29	2	8	8	43	----	288	2.38	38	8
Lemon Blush	Thorburn	" 17.	5	1	25	5	3	9	33	15	181	3.	47	4
Ferris Wheel	Salzer	Sept. 1.	----	---	16	8	10	5	26	13	96	4.36	99	6
Meteor	Thorburn	Aug. 17.	2	13	32	1	5	5	38	3	168	3.69	18	3
Northern Light	Thorburn	" 28.	6	3	10	8	15	9	32	4	201	2.51	55	8
Early Bermuda	Landreth	" 13.	11	14	24	6	1	8	37	12	216	2.61	30	9
Crimson Cushion	Henderson	" 22.	18	9	79	11	24	10	122	4	261	7.53	63	---
Cross No. 1	Va. Agl. College	" 13.	4	2	17	8	3	12	25	6	163	2.49	43	8
Cross No. 2	Va. Agl. College	" 17.	2	7	28	3	12	12	43	6	163	4.25	54	8
Cross No. 3	Va. Agl. College	" 13.	11	7	21	5	53	10	86	6	312	4.42	151	14
Cross No. 4	Va. Agl. College	" 13.	8	14	30	15	9	----	48	13	264	2.58	65	4
Brooke No. 1	F. W. Brooke	" 17.	3	9	37	8	7	15	49	----	181	4.33	47	4
Brooke No. 2	F. W. Brooke	" 28.	2	1	13	8	9	----	24	9	87	4.39	67	8
Halladay's Early Prolific		" 28.	----	----	3	15	5	1	9	----	37	3.89	63	15

Crimson Cushion, Henderson.—Plants of vigorous, spreading growth. Fruit very large; round, regular form; bright scarlet color; flesh solid and of best quality; cells small and few in number. The plants are very productive. The fruit is of fine form and appearance and will stand shipment well. A valuable variety.

Cross No. 1, Va. Agricultural College.—Ignotum type. Fruit round and very regular in form, colors evenly a bright dark red, and is of fine quality. Seems distinct in color and form.

Cross No. 2, Va. Agricultural College.—Acme type. Plants of strong growth and quite productive. Fruit of good size, regular form. Color is darker and more red than Acme. Excellent in quality, but rather soft. A good variety.

Cross No. 3, Va. Agricultural College.—Ignotum type, but lighter and brighter red in color. Ripens evenly and flesh very solid and firm. A good shipper.

Cross No. 4, Va. Agricultural College.—Closely resembles Ignotum, though fruits scarcely as large.

Brooke No. 1, F. W. Brooke.—Plants are not of strong growth, but quite productive. Closely resembles Acme.

Brooke No. 2, F. W. Brooke.—Closely resembles a well-selected type of Ponderosa.

By careful and continued selection of seed, *Earliest*, Vaughan, has lost much of its former angularity and has increased in size at no expense in earliness. It has again shown its superiority as an early-ripening sort.

Advance, ripening a little later than Earliest, but of smooth, regular form and good quality; is a valuable variety.

Ignotum, *Acme*, *Optimus*, and *Trophy* may be recommended as excellent varieties for general growing.

The following are sorts of recent introduction:

Ferris Wheel, Salzer.—Plant a strong and vigorous grower. Closely resembles Ponderosa in foliage and fruit, though the tomato is more regular in form and the flesh scarcely as coarse. It is a late-ripening variety.

Meteor, Thorburn.—The plants are alike in habit of growth and foliage, resembling closely Dwarf Champion. No two plants have the same type of fruit. The color varies from bright red to purplish red, and the form from round and slightly irregular to smooth and regular heart-shape.

Early Bermuda, Landreth.—Plant of low, spreading growth. Fruit of fair size, somewhat rough and angular. The variety is early and fairly productive.

Potato-leaf Ignotum, College.—This variety is rather late in ripening, but the large size, good form, and appearance of the fruit, and its good shipping qualities make it an excellent late market variety.

Terra Cotta, Thorburn.—This unique variety is especially valuable for its very high quality. It is moderately productive. It should have a place in the home garden.

Lemon Blush, Thorburn.—If one desires a yellow-skinned variety, no sort would give better satisfaction than Lemon Blush.

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Hanford, H. P. (deceased)	Bristol	*Indiana.*
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Hathaway, B.	Little Prairie Ronde	Cass.
Havilend, J. B. (deceased)	Traverse City	Grand Traverse.
Hayden, Mrs. H. A.	Jackson	Jackson.
Humphrey, J. W.	South Haven	Van Buren.
Husted, James D.	Vineyard	*Georgia.*
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Ilgenfritz, C. A.	Monroe	Monroe.
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Name.	P. O. Address.	County.
Lincoln, Mrs. L. C.	Greenville	Montcalm.
Linderman, Harvey J. (deceased)	South Haven	Van Buren.
Linderman, A. T.	Whitehall	Muskegon.
Littlejohn, F. J. (deceased)	Allegan	Allegan.
Loomis, P. B.	Jackson	Jackson.
Lyon, T. T.	South Haven	Van Buren.
Mann, S. B.	Glenwood	*Florida.*
Marshall, William A.	Old Mission	Grand Traverse.
Mason, L. M.	East Saginaw	Saginaw.
Mason, Mrs. Sarah A.	East Saginaw	Saginaw.
McCallam, E. H.	Lansing	Ingham.
McClatchie, G. C.	Ludington	Mason.
McDiarmid, James D.	Bear Lake	Manistee.
McNaughton, Robert T.	Jackson	Jackson.
Mitchell, W. H. C.	Traverse City	Grand Traverse.
Moores, J. H.	Lansing	Ingham.
Monroe, C. J.	South Haven	Van Buren.
Monroe, Judge (deceased)	Lawrence	Van Buren,
Montague, A. K.	Traverse City	Grand Traverse.
Nabors, Nellie S.	Flint	Genesee.
Nichols, W. W.	Ann Arbor	Washtenaw.
Noble, W. A.	Monroe	Monroe.
Odell, Samuel W.	Muskegon	Muskegon.
Palmer, Thomas W.	Detroit	Wayne.
Parmelee, George (deceased)	Old Mission	Grand Traverse.
Parmelee, Mrs. George (deceased)	Old Mission	Grand Traverse.
Parke, Mrs. Amos S.	East Saginaw	Saginaw.
Parsons, Philo	Detroit	Wayne.
Partridge, B. F.	Bay City	Bay.
Pearsall, S. M.	Grand Rapids	Kent.
Perry, George L.	Lansing	Ingham.
Petty, Thomas	Spring Lake	Ottawa.
Pierce, N. B.	Ludington	Mason.
Potter, E. M.	Manderson	*Nebraska.*
Ramsdell, J. G.	Traverse City	Grand Traverse.
Ramsdell, Mrs. J. G.	Traverse City	Grand Traverse.
Ransom, W. D.	St. Joseph	Berrien.
Renwick, T. R.	Grand Rapids	Kent.
Reynolds, E. H.	Monroe	Monroe.
Reynolds, H. G.	Agricultural College	Ingham.
Rich, Hampton	Ionia	Ionia.
Root, Amos	Jackson	Jackson.
Rose, D. Forsyth	East Saginaw	Saginaw.
Rose, Mrs. Sophie E.	East Saginaw	Saginaw.
Rowe, William	Grand Rapids	Kent.
Rowe, William N.	Grand Rapids	Kent.
Russell, Dr. Geo. B.	Detroit	Wayne.
Rust, C. E.	Ionia	Ionia.
Satterlee, James	Albany	*New York.*
Savidge, Hunter (deceased)	Spring Lake	Ottawa.
Scott, J. Austin (deceased)	Ann Arbor	Washtenaw.
Scott, Dr. Austin	Newark	*New Jersey.*
Scott, E. H.	Ann Arbor	Washtenaw.
Sessions, Charles A.	Mears	Oceana.
Sessions, Alonzo (deceased)	Ionia	Ionia.
Sessions, William	Ionia	Ionia.
Shirts, E. J.	Shelby	Oceana.
Shoop, Rev. D. R.	Hastings	Barry.
Sinclair, W. G.	Grand Rapids	Kent.

Name.	P. O. Address.	County.
Sigler, Artimus	Adrian	Lenawee.
Slayton, Asa W.	Grand Rapids	Kent.
Sleeper, F. S. (deceased)	Galesburg	Kalamazoo.
Smith, E. T.	Ionia	Ionia.
Smith, N. E.	Ionia	Ionia.
Smith, H. H.	Jackson	Jackson.
Soule, J. B.	Fruitport	Muskegon.
Staunton, G. W.	Grand Rapids	Kent.
Stearns, J. N.	Kalamazoo	Kalamazoo.
Stearns, Ida L.	Kalamazoo	Kalamazoo.
Steere, B. W.	Carthage	*Indiana.*
Sterling, F. S.	Monroe	Monroe.
Sterling, J. M.	Monroe	Monroe.
Sterling, J. C. (deceased)	Monroe	Monroe.
Sterling, W. C.	Monroe	Monroe.
Sterling, W. P.	Monroe	Monroe.
Sterling, Mrs. Emma M.	Monroe	Monroe.
Stockbridge, F. B.	Kalamazoo	Kalamazoo.
Suttle, John (deceased)	Grand Rapids	Kent.
Taylor, George	Kalamazoo	Kalamazoo.
Taylor, George C.	Kalamazoo	Kalamazoo.
Thomas, H. F.	Jackson	Jackson.
Thompson, W. D.	Jackson	Jackson.
Tompson, J. P. (deceased)	Detroit	Wayne.
Towles, George W. (deceased)	Henton Harbor	Berrien.
Tracy, Will W.	Detroit	Wayne.
Vick, James (deceased)	Rochester	*New York.*
Vick, James, Jr.	Rochester	*New York.*
Vick, Frank H.	Rochester	*New York.*
Vick, Charles H.	Rochester	*New York.*
Vick, E. Colston	Rochester	*New York.*
Wadsworth, W. R.	Lapeer	Lapeer.
Waite, Gilbert M.	Paw Paw	Van Buren.
Walker, S. S.	St. Johns	Clinton.
Watkins, L. D.	Manchester	Washtenaw.
Webber, William L.	East Saginaw	Saginaw.
Webber, George W.	Ionia	Ionia.
Webber, Miss Frances E.	East Saginaw	Saginaw.
Wells, H. G. (deceased)	Kalamazoo	Kalamazoo.
Whittlessey, John	St. Joseph	Berrien.
Wier, Antoine	Monroe	Monroe.
Wilde, Thomas	Herrington	Ottawa.
Williams, S. P.	Monroe	Monroe.
Winchester, A. O.	St. Joseph	Berrien.
Wooding, Charles F.	Lowell	Kent.
Woodward, David	Clinton	Lenawee.
Wurtz, Elias H.	East Saginaw	Saginaw.
Zeigler, J. C.	Saginaw City	Saginaw.

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